Index Supplement to the Electrical Review,
January 1st, 1897.

THE

ELECTRICAL REVIEW.

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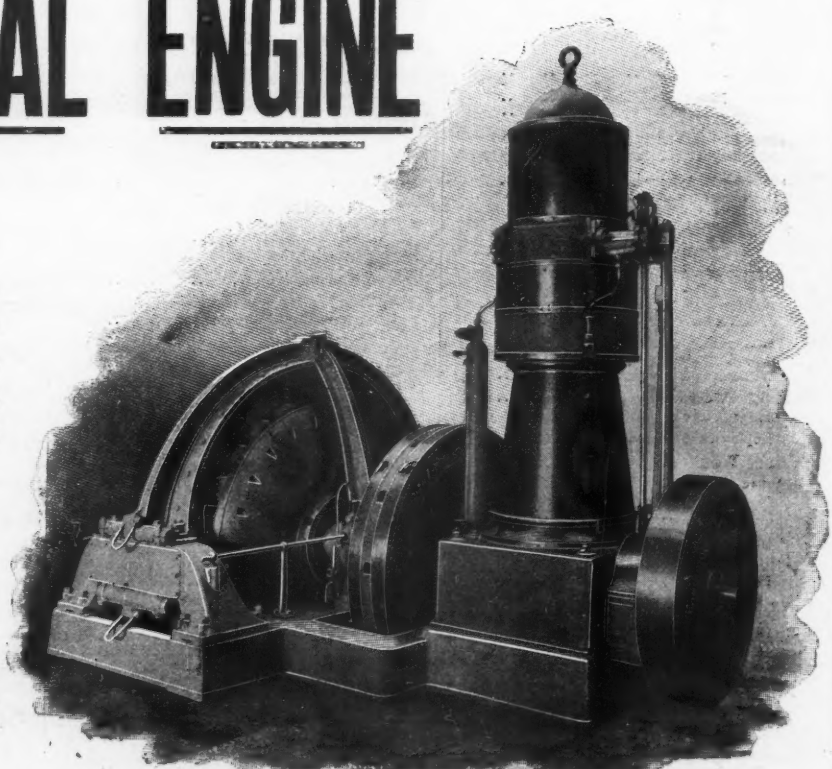

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MONOPOLY.

WE have no thought of the consequences of hurting the susceptibilities of our kinsmen across the Atlantic, as our contemporary the *Electrician* seems to fear, but on the other hand we think the greatest benefit which can accrue to them would be fair criticism without the too frequent preceding apology which we are becoming tired of hearing. We do not, however, think this is a point our contemporary wishes to accentuate in its very extraordinary article of last week. The endeavours said to have been made to inaugurate and bring into force means to control the domination of the Western Union Telegraph Company in the United States have been, we learn, abortive in effect. They seem to have been legitimate enough, and, so far as we know, were made in a constitutional manner through the legislative houses—the Senate and the Congress—and, in view of a common danger complained of by American citizens, made the change of control of the United States telegraphs from the company to the Government imperative. We find that the Western Union Telegraph Company's lines and cables extend throughout the United States, to Mexico, to Havana in Cuba, to many parts of Canada and to Great Britain. At the present moment we learn from our contemporary in one sentence, that the United States Government are, apparently, afraid to tackle in any manner this dominating telegraph system, and in another we are informed that means are being offered to meet the case, such as competing lines by fast methods over at present the most prolific traffic grounds only; and, we presume, to be extended, if the recalcitrant company is not brought to feel that a proper settlement would be wise. Our contemporary, referring to the purchase of the lines throughout the United Kingdom, says:—"The existing services were bought and paid for handsomely—too handsomely, perhaps—by the British Government, and we have not grudged the money." This remarkable statement seems to point to the squeezing of our Government, but we think the last word has not been said as to its acceptance in a spirit of resignation, or grudgingly. We would prefer to have known that the lines were taken over at a fair price. Now, we find another remarkable statement:—"If the United States cannot, or will not, do the like (*i.e.*, pay too handsomely, we presume), it had better try its hand at regulating the monopoly in the public interest, a task, we should imagine, far easier and less risky than attempting to extinguish it by arbitrary and rapacious competition." Saint Telegraph! We have known for the last few years that competition is so named when applied to the telegraph business. Competition may only be said to be "keen," if one is a cotton dealer or a trader in timber! The

reason for this different appellation is, that in "cotton" a "corner" is immediately looked upon as a common enemy, and competition kills it, while in telegraphy competition has, with few exceptions, been strangled. That this is so, is apparent in the United States, if the Government of that country has to enter into battle with a company—a not very dignified position—to protect the interests of the general public. We do not agree with our contemporary in its deductions, but we think the position should be faced, and measures, drastic or otherwise, necessary to bring about the change, should be taken by any Government in such an unfortunate position. We think no monopoly would face them, if they were convinced that the Government had made up its mind to "tackle" it. The Postal Telegraph and Cable Company, of New York, successfully shouldered all attempts of forcing them into the monopoly, and the methods applied to bring this about, and which had succeeded in all other cases, were completely foiled. Submarine cables were laid across the Atlantic by the friends of the Postal Company, and domination and high charges were both successfully fought and broken down. We find in England again this monopoly! Unless we are very much mistaken—and we fear there is only too much truth in the general belief — the arrangement of the Atlantic cables (excepting the Commercial Cable Company) is to "pool" all the earnings. This practically means that they are one complete company. The Western Union Company is part of this "pool," and the Direct United States and the Anglo-American Companies complete a condition of things which is not found in any other trade. We find these companies more or less dovetailed into the West Indian, the Eastern, the African, the Brazilian, and with only one or two exceptions, with all the telegraphic communications throughout the world.

They are, in our mind, one vast monopoly, and by what means the two or three small systems have evaded the draught of hurricane pressure, and kept themselves clear of domination, will perhaps never be known. We think, however, they deserve well of their country, and we are of the opinion that any enterprise having for its object the making of a power large enough to successfully contend with any vast monopoly, whatever the nature of its trade may be, should receive the help of any statesman who has in view the prospect of paying handsomely—perhaps too handsomely—for lines of communications which should have been kept in the hands of any Government, and which must get there sooner or later. There are two chances now open to our legislators, and we think they should not be indifferent to them, but accept the present time—which our contemporary says was once open to the United States Government, but which was allowed to slip away—to free British lines, as far as they can, from foreign or British control. We are of the opinion that the projected lines to the West India Islands and to Australia, *via* the Pacific Ocean, if they are laid, should be done by the British and Colonial Governments themselves, or undertaken by those free of domination. And we think any statesman, if he is properly advised and understands the question, will agree with us, that when affairs are in an acute stage it is well to face them with whatever methods may have been left to his hands. We do not, however, expect our contemporary to agree with us.

Motor Carriages.

In reference to our article of last week on motor carriages, Sir David Salomons writes to the effect that a couple of horses will haul a brougham and four passengers up Richmond Hill—a gradient of 1 in 10—the laden vehicle weighing a ton, yet a motor carriage of equal weight requires a motor of 4 H.P. That some such difference exists in the power required to pull a vehicle and to push it is, we take it, attributed by Sir David to the fact well recognised in respect of barrows and small hand trucks, that the wheels of a pushed vehicle are less favourably placed than when pulled. Obviously, if a horse does not pull horizontally but somewhat upwards, the front wheels will be lifted, and the question arises is their any necessity for the small front wheels commonly used on horse vehicles? Americans do not use small wheels on the buggy, and the leading wheels on this carriage are so large as to make entrance rather awkward. Is it possible that much of the difficulty with our own carriages would disappear were the leading wheels made so large that the thrust of the rear wheels was in a line below the leading axle? We think with this arrangement that the running would certainly be easier. With a 4 H.P. motor, mounting a hill of 1 in 20 is, says Sir David, very serious work, and a big stone will stop the vehicle. Given an additional 4 H.P. and the trouble disappears, given a total of 12 H.P. and the horse will never be in it with the motor. On the other hand, we have before us a copy of a letter written by a gentleman of France, who states he has mounted hills with a 12 per cent. gradient with his motor Victoria and three passengers: it is not quite clear if there were four persons in all or only three. Generally there appears to be a mass of evidence as to the fairly satisfactory nature of motor vehicles in France, and even in Russia and South America. At the same time, we can quite understand that Sir David, who drives a good horse, may have less reason to draw favourable comparisons with the motor carriages than many other people, and there is, perhaps, no worse area for roads than the Weald of Kent or Sussex as regards continual and steep hills. In his regard for steam, we suppose that he has in view the possibility of carrying steam the full stroke of the piston for short periods, whereas an oil engine cannot work other than expansively. Makers of motor carriages would do well to take a note of the abnormal absorption of power by the inefficient action of the leading wheels. This is a difficulty that ought not to be insuperable, and is, we think, explicable on the lines we have indicated. A horse when exerting a horse-power in work done externally to himself is, of course, doing a good deal more when his own weight is taken into consideration, and on a hill the horse is, perhaps, really doing a good deal external to himself more than a horse-power. We should like to have from any one who has tried it, any dynamometer tests which will show, at given speeds, the tractive pull of a horse on an ordinary carriage. Perhaps Sir David can furnish something of the sort from the many experiments he has made.

The Institution of Electrical Engineers.—A special general meeting of the members and associates of the Institution will be held at the offices of the Institution, 28, Victoria Street, Westminster, on Monday next, July 6th, 1896, at 4.30 o'clock in the afternoon, for the purpose of receiving the statement of receipts and expenditure and balance-sheet for the year ending December 31st, 1895, as amended, and for considering the following proposal in reference to the building fund, and for passing such resolutions as may be thought fit in relation thereto, viz.:—"That the building fund, which is now but a sub-division of the funds of the Institution, shall be made a permanent 'building fund,' and that the interest accruing from such fund, or the investments thereof, be added to the fund from time to time."

SUBMARINE CABLES IN WAR TIME.

In one of first messages which passed through the first Atlantic cable, and which was sent by Mr. Buchanan, President of the United States of America, to Her majesty the Queen, the following hope is expressed, "Will not all nations of Christendom spontaneously unite in the declaration that it shall be for ever neutral, and that its communications shall be held sacred in passing to their places of destination, even in the midst of hostilities?"

Nearly 40 years have elapsed since this message was sent. During this time cable after cable has been laid, but in spite of several International attempts to assure the neutrality of submarine cables in war time, no agreement has yet been concluded. On consideration, it is apparent that any such agreement is not at all likely to meet with general acceptation among the nations. Great Britain stands alone in this question. To no other nation can the need of neutralising the lines of communication appeal with such force, and for none has it the same interest. With colonies and troops in every quarter of the globe; with war ships and coaling stations in every ocean, and depending for her very food supply on other lands, it is useless to expect that, even nominally, the potential adversaries of England (and they are many) would agree to place themselves at a disadvantage, such as would result from guaranteeing continuity to the very means which might prove to them a source of defeat and disaster.

We may here recall to mind the good work done in the beginning of the century by Lord Cochrane, who was detached from the fleet in independent command, and destroyed the semaphore stations (the telegraph of that day) along the coast of the Gulf of Lyons, thus rendering most valuable service to the troops on shore by hampering the movements of the enemy. In this case, the interruptions being on land, could cause no great delay; but if we consider the effect which would be produced by the cutting of the cables, which now unite England with India and the Colonies, we find food for very serious reflection.

To those who have studied the cable routes which connect England with her possessions and with other countries, and which unite the English Colonies with each other, it is not difficult to appreciate the ease with which, in the event of a war with any first-class power, the whole network of cables would be destroyed. To some of our readers we may seem alarmist in our views, but it should be borne in mind that the great network of submarine cables, through which we are daily supplied with news from all parts of the world, has been constructed since the last serious war in which this country has been engaged, and that for this reason the attention of the public has not been called by experience to the great value of our cable system during the time of stress, or to the great loss which its damage would entail. It is true that this has been indicated to us in a small degree recently. We refer to the interruptions to the cables to South Africa during the troubles in the Transvaal; although working unsatisfactorily at this critical period, the cables managed to serve their purpose to the extent of carrying the messages from Mr. Chamberlain, which saved the situation, and which undoubtedly prevented another Boer war, and possibly even much more serious consequences in Europe. The delay of telegrams and consequent anxiety also had the effect of showing the great value of reliable cable routes.

We may here refer to some occasions less generally known, from which the vital importance of submarine cables in war time can be estimated. During the Franco-German war, when the landline system in France changed hands to a great extent, a cable was laid along the French coast from Dunkirk to Bordeaux, landing at various points. Although the ship which laid this cable was accompanied by two large French war vessels, the cable was no sooner laid than it was picked up and cut by a small German gunboat. On the West Coast of South America during the war between Peru and Chili, the Chilians cut the cables which formed the only source of communication between the various coast provinces of Peru, and later, during the insurrection against President Balmaceda's Government in Chili itself, the submarine cables were cut, thus destroying the hope of any organised action between the Government troops in the northern and southern provinces. It may not be generally known that when the first shot was fired in the bombardment of Alexandria the lines were immediately cut by the Egyptians; and thus, for her communication with India, Australasia, China, and the East generally, England had to rely either on the overland wires, which, crossing various European countries, run through Turkey and Persia to India and the East, or, as an alternative, on the other landline, which, running through Russia and Siberia to the Russian stronghold of Vladivostock on the Pacific coast, forms a roundabout means of communication, *via*, China, with the Straits settlements; there meeting lines to Australia and India. Again, some few years ago, when great political tension existed with Russia, the cables which united Australasia with the rest of the world were interrupted simultaneously, this sudden cessation of news caused much uneasiness in Australia, and led to the immediate mobilising of the Colonial troops, the manning of batteries, and to the putting in active commission of the Australian defence ships.

There are other instances, on which we will not now enlarge; but it may be right to recall to the attention of our readers a statement made to the House of Lords by the Earl of Carnarvon, who pointed out to the House that in 1878, when there were great alarms as to a Russian war, the Russian Government had taken measures to equip ships for cutting our submarine cables. That this would have been an easy matter is obvious, when we remember, as has been already pointed out in this Journal, that in the Java seas, and the south-west part of the China Sea, there are some 3,500 miles of telegraph cable which lie in less than 50 fathoms of water, and which could be broken by any vessel carrying only the ordinary supply of chain and anchors. Now the above, as far as ocean telegraphy goes, may be looked on as ancient history; but as history is said to repeat itself, it would be unwise of us to close our eyes to such warnings. To poets and orators, a state of "splendid isolation" might form an inspiring theme; but to more practical minds, such a state of affairs could only be looked on with serious misgivings.

Holding, as we do, the views above outlined, it is with much satisfaction that we find in the report of the Congress of the Chambers of Commerce of the Empire (an extract from which we reproduce elsewhere) that the necessity for adding to, and amending, our present cable system, has been so thoroughly recognised and advocated by this influential meeting of the representatives of Greater Britain.

"EXTENSIONS TO OUTLYING DISTRICTS."

The paper bearing the above title, which was read at the recent Convention of the Municipal Electrical Association, was one which might have given rise to a very useful and interesting discussion.

Without doubt, the problem—a solution of which was proposed in the paper—must be seriously faced, and that very shortly, too, both by municipal and company engineers.

There can be no hard and fast law laid down either as to the advisability of an extension to suburban districts, or the economic results upon the working of the station; local conditions must be taken into account.

But, dealing with the first part of the question as laid down by the author, viz., the relative capital costs of mains in the central and outlying portions of the town: Seeing that the cost of mains does not increase in the same ratio as the section of copper, but only as slightly more than the increased cost of the copper itself, the capital outlay required for a large main fully loaded is less per lamp than a main of smaller section.

Now, the general rule in suburban districts is to give a greater frontage to the houses than in the central districts, and also, as pointed out by one of the speakers, the luxury of long gardens is indulged in. Therefore, it follows that the lamp density per yard of main in the outlying districts cannot be as great as in the central portion of the town, and that the cost of services will be excessive, unless the engineer adopts the suicidal policy of charging for the additional length of service main.

The figures given by one of the members as to the respective costs of these mains per lamp installed in Brighton

(£30 and £2 18s.) are certainly somewhat alarming, and we presume that the outlying district is not yet fully supplied. Be that as it may, the figures conclusively prove, in our opinion (1) that the cost of mains per lamp is, and must be, greater in the outlying district than in the central portion; (2) that considerable time must elapse before the outlying districts are fully supplied. The central station engineer would do well to remember that during this period interest must be paid upon the capital expended, and that the mains must be kept in working order.

Now, with regard to the effects which an extension to outlying districts will have upon the economic results of the station. The author of the paper in question places the very high value of three upon each lamp installed in the outlying district as compared to a lamp installed in the central. We scarcely think the circumstances even in Bradford justify his doing so. Certainly, from personal experience we can say that the central portion of Bradford is practically deserted after 9 p.m.; but then Bradford has a good power day load, which cannot be found in an outlying district.

This brings us to the question as to what should be termed an outlying district. The author appears to be rather unfortunate in his choice of an example. We should be inclined to differ from him as to the propriety of terming a street which contains some 80 shops, three hotels, and one theatre, and only 95 houses, as an outlying district.

In order to arrive at the average lamp hours per day in different towns, evidently with a view to emphasising the necessity of the outlying extensions, Mr. Gibbings has taken the figures given in a contemporary, representing the "units sold per lamp installed" for eight provincial towns. From these he has deduced the average hours per day that each 8 C.P. lamp (equivalent) would be burning. This is an error of logic, being in no way evidence of the station load factor, and, until we know the ratio of the maximum demand on the station to the possible demand from lamps (or equivalent) installed, the figures are valueless.

There is a very interesting (hypothetical) station load curve included in the paper. We wonder whether it will commend itself to the author's brother engineers as an example of practical foresight. To our manner of thinking Bradford must be a peculiar town if the *whole* of the load from the outlying district remains on until after midnight, and reaches its maximum at precisely the same instant as the load from the central portion.

We doubt very much the accuracy of the curve as even approximating to the conditions existing in Bradford or any other provincial town. It seems to us that the sole benefit arising from the load from outlying districts is the fact that its maximum does not coincide in point of time with the maximum of the central load, and that, therefore, the station maximum is not the sum of the two maxima, and the time period of the station curve is greater than the periods of its components.

Our advice to central station engineers is to obtain as great a variety of class of load as possible, as by this means the ratio of maximum demand to the total output will be lessened.

Certainly, the author is well advised in contemplating the extension, but we would recommend him not to be disappointed if the results fall short of his very sanguine estimate.

ELECTRICITY WORKS RECORDS.

Mr. A. B. Mountain, borough electrical engineer, Huddersfield, laid before the M. E. Association a short paper on "Electricity Works Records," which, although we thoroughly approve the spirit we cannot commend for being full and comprehensive, but rather the reverse. The impression given one in studying the same is that the author had a fairly good idea of what was wanted, but was unable to fill that want.

A few record sheets are given, which only tend to confuse the mind rather than otherwise; for instance, a few records of the engine room costs, plant and main testing, time sheets, store sheets, are shown together with an electric supply station cost sheet, which is offered as a summary of all the other sheets, the summary being drawn up in a manner so different from the separate records that it would be impossible to summarise them under the heads given. The analysis of the different records or their allocation under their different heads in the books of the concern are not touched upon, in fact, not even mentioned, and as there is no means of tracing where the particulars are entered up, we are driven to assume that no books are intended to be kept. The Board of Trade insists only on a return showing the total expenditure under different heads, but the wise engineer will keep his records and prime cost books, so that the cost of every item of expenditure can at once be at hand for future reference.

The value of an efficient system of engineering records is incalculable, but to be of any practical use they must be drawn up in accordance with the form arranged by the Board of Trade, and in conjunction with a proper system of books, the whole being kept well up to date.

From an engineering point of view it is essential to read the meters frequently, so that the particulars can be entered on the working analysis sheet for the purposes of comparison. Many engineers consider the reading of meters once a week in small towns, or once a fortnight or month in larger towns to be an impossibility, but we can produce sufficient evidence to prove that such is not the case.

The Association resolved to refer Mr. Mountain's paper to a committee, the object of which would be to obtain information and formulate a system of record keeping which could be universally adopted by the members of the Association, a resolution which we consider wise, and we would urge them to proceed without delay to attain the object in view if Mr. Mountain's paper is a fair sample of the methods employed by municipal engineers in general in dealing with their records and accounts.

ORGANISATION OF AN ELECTRICITY WORKS STAFF.

Mr. E. T. Ruthven-Murray's short M. E. A. paper on the "Organisation of an Electricity Works Staff" contained much that could well be taken to heart by station engineers, consequently we are not surprised to find that few engineers and committeemen differed from Mr. Murray. The last paragraph of the paper caused quite a sensation, but why it should have done so seems strange, unless it was sympathy expressed for the more unfortunate municipal electrical engineers who have not a free hand in the selection of the members of the staff. It is well known that some committees adopt the policy of engaging the different members of the staff, and, what is still worse, discharge them, so that the chief engineer is in the uncomfortable position of being unable to exercise that authority over his men which is absolutely necessary that he should do in cases of insubordination or neglect of duty. Surely, if the chief engineer is qualified to take entire charge of such an important concern as an electricity supply station, the successful working of which entirely depends upon his management, it is very short-sighted policy to so tie his hands that he can only suspend a man in cases where instant dismissal is the only effective method. The custom of committeemen and councillors insisting on the employment of certain men and youths is one which cannot be too strongly condemned. A glaring example of this was before the electrical world some months ago, which happily ended in the men who took upon themselves the responsibility of reporting their chief getting their dismissal.

In the discussion which followed, Mr. Albert Gay said he did not believe in fitter-drivers, for a man that could do everything could do nothing well. Some engineers instead of putting in charge of the engine room a youth, styled "engineer-in-charge," or "assistant," have chosen men of somewhat mature years, who, having served their time as engineers, and probably obtained their first-class certificates as marine engineers (this fact being sufficient guarantee of a man's education and intelligence), have proved to be not only reliable, but able to take complete charge of the whole of the engine room during their watches. It would be a downright insult to style this type of man a "fitter-driver," for in many cases their extensive

experience in mechanical engineering is very much greater than that of their respected chief engineer, who must necessarily be a man of many qualities; consequently one is astonished to find expressions of opinion such as that to which we have referred. Mr. Dawbarn touched the matter in a lighter vein, and suggested a sort of barrack station, in which some of the staff would reside, but he would occupy a minimum staff on actual duty in the engine room, and have at his immediate call a relay of men in pyjamas carefully tucked away in bed, who would be prepared to turn out in cases of emergency. Mr. Dawbarn did not state whether he was prepared to pay these men for their solitary confinement in bed during the hours when they were off duty.

THE "PERMISSIBLE DROP" IN SMALL DYNAMOS.

The points raised in the action brought by the Electrical Construction Company against Messrs. Hurry & Young, electrical engineers, at the Edinburgh Court of Session, and briefly reported in our last week's issue, were of a highly interesting character, and of considerable importance to the industry in general.

It appears that the defendants entered into an agreement to put down a small isolated plant for a firm of jewellers in Edinburgh. The plant comprised a gas engine and a dynamo of about 4½ units capacity, driven by a belt. The first feature in the case is the surprisingly bald and open character of the order given by them for the dynamo. They requested the Electric Construction Company to supply "one No. 3 dynamo giving 115 volts, 40 amperes, at approximately 1,100 revolutions, with extra bearing and slides for tightening belt, and also balance-wheel about 1 cwt." Nothing, however, was specified as to the qualifications of the machine in the way of heating, ability to maintain the full load, or as to the variation in the pressure with a change in the load. We should not have been astonished to see such an open order given by a local gasfitter or a private individual, but that a firm of electrical engineers should issue their orders in such a fashion is remarkable, and under the circumstances we are scarcely surprised that it was soon found that the machine did not do all that was expected of it. The defect was of a somewhat peculiar nature. The machine when first started, and while still cold, gave the specified pressure of 115 volts at the specified speed; but it was discovered that after a few hours' running, the voltage fell to 110. The effect upon the lamps was, of course, bad, and on complaint being made a second machine designed to run at a slightly lower speed (1,070 revolutions) was supplied; but this machine very soon developed a flat on the commutator. A fresh armature was next supplied, but the trouble did not end there, for it was then found that the new machine was even worse than the first, in that the fall of pressure, after a few hours' run, was from 5 to 10 volts, or even more. The effect was, of course, disastrous, and the jewellers declined to accept the machine, whereupon the contractors requested the Electrical Construction Company to send a representative to test it. This they agreed to do. The test was made, and after an hour's run a fall of 5 volts was observed. The lead of the brushes was then altered, with a view to restoring the pressure, and as the result of various alterations during the test, the company's representative handed to the defendants certain figures indicating a sustained voltage. But, say they, in their Statement of Facts, "these figures are inaccurate and untrustworthy in respect that they ignored the alteration in the lead of the brushes, and were not accurately read from the voltmeter. Mr. Gardner (the company's representative) made no allowance for the swing of the needle caused by the action of the gas engine as the driving power."

The distance between the driving centres appears to have been unduly short, and, therefore, conducive to slipping; and we are not all surprised to find conflicting testimony as to the actual pressure obtained, neither are we astonished to learn that ultimately Messrs. Hurry & Young requested the Electrical Construction Company to remove their machine, if they could not make it work without a drop of more than 4 volts. Matters were then approaching the climax, and the Electrical Construction Company set up the contention that the ordinary fall of voltage varies from 7 to 10 per cent. in the case of a small dynamo *not constructed under special stipulations*. Herein, we think, lies the secret of the whole situation. The fall in pressure is, of course, with constant speed, due to the heating of the conductors by the current itself, and the rise in temperature must have been very great to have caused a fall of 10 volts. We can only attribute such great heating to the insufficiency of copper and the want of ventilation, and it appears to us that the keen competition in the dynamo trade is in the main responsible for what we cannot but consider the unwise economies which are very frequently manifested in the practice of dynamo construction. Had the defendants simply specified a temperature test, larger conductors would have been employed, or, as is frequently done in such cases, a larger machine would have been estimated for; the increase of temperature would have been correspondingly small, and the voltage would then have approached more nearly to the uniformity necessary for lighting purposes. It is a lamentable fact that many manufacturers find themselves compelled to list their machines at too high a rating in order to attract customers who purchase after an examination of competing catalogues, and it is consequently found that when a dynamo is properly specified, it is often the practice to supply a machine a size larger than the one listed for the required output.

It was found by Prof. Bailey, acting on behalf of the makers, that the second machine, when run cold at a speed of 1,021 revolutions, gave a pressure of 116½ volts, and that after running at the same speed for some hours, the voltage dropped to 106. On increasing the speed to 1,065 revolutions (or five less than the number specified by the makers), a pressure of 115 volts was obtained. Accordingly the contention is raised that no guarantee was given that 115 volts would be continuously maintained without change of speed, and that the speed marked on the machine, as necessary to give the required voltage, was to be considered as the "hot" speed, and not the starting speed.

Here we must join issue with the makers, for surely, if the specified speed is to be taken as correct at about the time when the need for the use of the machine has passed away, or even at any other portion of its daily or nightly run, that fact should be clearly indicated to the purchaser in some way or other.

It was further contended that the variations in pressure should be met or counteracted either by the employment of resistance coils, to be cut out as the temperature rises and the volts fall, or by increasing the speed of the engine. We cannot help thinking, however, that if the makers were aware of this, it was their duty, and to their interest, to inform Messrs. Hurry & Young of the fact when they accepted the order from them.

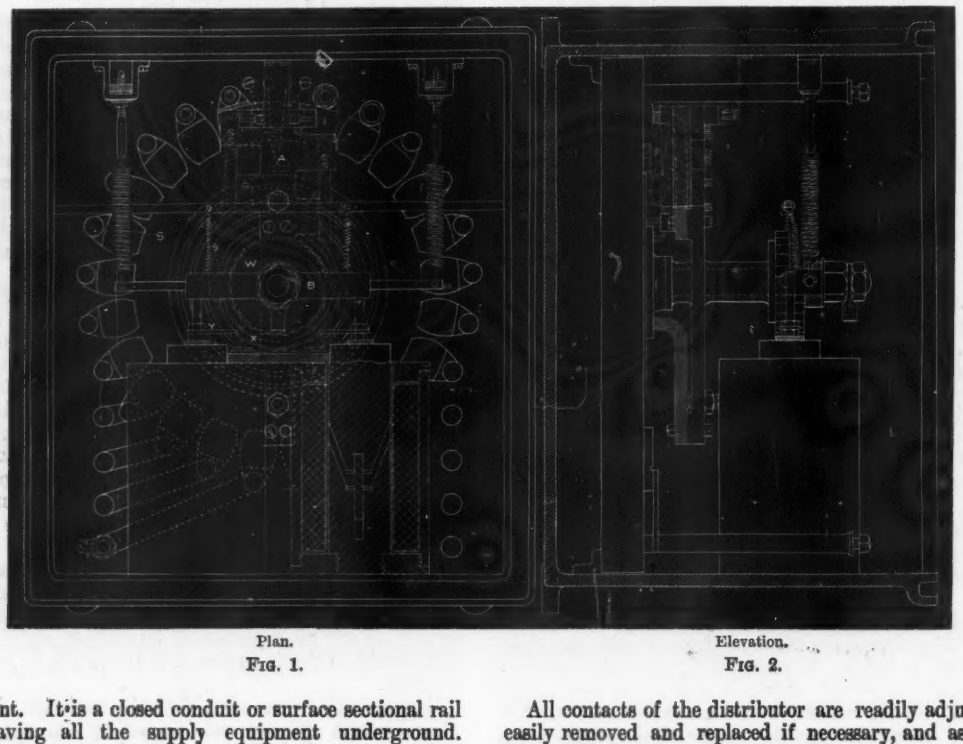
Were it a fact that all dynamos require such continual attention and adjustments of the kind suggested, the country house installation run by the gardener or other odd man would be impracticable, and we must say that, so far as our experience goes, a variation of 10 volts is both abnormal and excessive. As we have said, the evidence of the witnesses was of the usual contradictory nature characteristic of expert testimony, and we can appreciate the difficulties of Lord Low in the face of the "direct conflict between the skilled witnesses." We can, nevertheless, congratulate his lordship upon having taken a very masterful view of the situation, and his judgment, which went entirely against the makers, is one which we commend to the serious attention of both makers and users of electrical machinery.

PRINGLE AND KENT'S SURFACE RAIL ELECTRIC RAILWAY.

There are many prominent engineers who hold the opinion that the overhead wire system is not the form in which electric traction will mainly progress in this country. It is perfectly true that there is a vast amount of opposition to its use in the streets of London, and there is not much reason to hope that there will be a speedy conversion to the overhead system. We should not care to say what system is likely to find favour in the eyes of the authority that shapes our ends, but it is clear that it will be face to face with the

necessity of providing some improved form of power on the newly municipalised tramways. Having regard to the discussions that have been raised from time to time, we are a little anxious as to the manner in which such an important problem—involving tremendous interests—will be overcome.

One cannot help admitting that a system which has none of the drawbacks of the overhead wire, and is at the same time reasonably cheap to construct and easy and economical to work, will probably go a long way towards helping on electric traction. We have recently had the pleasure of examining what is called a surface rail electric railway, which is the joint invention of Mr. P. J. Pringle and Mr. J. M. V. Money-Kent. It is a closed conduit or surface sectional rail system, having all the supply equipment underground. There are about 13 automatic switching devices or distributors per mile of track; these being placed about 135 yards apart, preferably under the footpath for convenience of inspection. The distributor is shown in plan and section at figs. 1 and 2, and consists of two electro-magnets, M^1 and M^2, the movable armatures of which are coupled to each end of the rocking bar, B. If M^1 is magnetised, its armature is sucked in, drawing down the bar, B, against the action of the spring, S, and allowing the pawl, P, which is thrown over by the small spring, S, to engage in a tooth of the ratchet wheel, W, adjoining the one it was previously opposite, at the same time the left-hand catch, X, is disengaged from its ratchet wheel by the plate, Y. On M^1 becoming demagnetised the spring, S, draws back the movable bar, which, by the aid of the pawl and ratchet wheel, moves the main supply switch arm, A, together with the shunt contact arms on each side of it, from the position shown to contact 1, and the left-handed catch, X, returns and locks same. The magnet, M^2, acts similarly in the reverse direction. Should, however, the line be double track, and cars only required to move in one direction, only one magnet, ratchet wheel, &c., and one shunt arm is required. The parts are mounted on a slate base and contained in an iron box filled with a light oil, which has the advantage of reducing wear and tear to a minimum, and keeping out dirt and moisture. The contact pieces have rods continued from them, so that the cables can be connected to the same at a level above the oil. The cables pass out of the box through glands, so that the box can be kept watertight.



Plan. Elevation.

Fig. 1. Fig. 2.

All contacts of the distributor are readily adjustable and easily removed and replaced if necessary, and as the main arm never breaks any current, and the shunt arms have, during the major part of the time they are in action, only a fraction of an ampere passing through them (this being the exciting current required for the magnets), the wear and tear in these is said to be exceedingly small. Of course, during the short circuiting of the magnets, a larger current flows, but the sparking is very little due to the self-induction of the magnets.

Distributor No. 1. Distributor No. 2.

Fig. 3.

Fig. 3 shows diagrammatically the connections for two distributors arranged for working cars in either direction. Each distributor has 24 contacts, feeder cables running from these right and left to 24 of the surface rails. All the distributors are in parallel between the main supply cable, C, and the rails, E, which act as the return to the source of supply, D.

The action of the distributor is as follows:—Supposing the tramcar to be receiving current from surface rail No. 16 of distributor No. 1, and travelling in the direction of the

arrow. The main switch arm of distributor is on contact No. 16, and two of the shunt arms on contact No. 15. By following the connections, magnet M^1 will be magnetised by a shunt current flowing from main conductor, C, through M^1, one of the shunt arms on contact No. 15, then through the resistance, R^1, to the tram rails on return. These connections are more easily seen in fig. 4A. On the car advancing so that the collectors under the car bridge across the surface rails Nos. 16 and 15, as in fig. 4B, it will be seen that M^1 is short-circuited by the cable supplying current to contact 16. This causes the main arm of distributor to be switched on to contact No. 15, as in fig. 4C, when immediately the magnet M^1 becomes magnetised again ready for a similar action to occur. When the car is passing from the block controlled by one distributor to an adjoining one, the additional contacts (see fig. 3), by No. 1 and 24 contacts, and

Distributor No. 1.

FIG. 4.

Distributor No. 1, Distributor No. 2. Distributor No. 1. Distributor No. 2.

FIG. 5.

the shunt connections shown dotted together with the two outer contact arms, are then and then only brought into requisition. Fig. 5A shows the connections which occur when the car has reached the surface rail No. 1 of distributor 1, and is about to enter the block controlled by distributor 2. Magnets, M^1, of both distributors then become magnetised through their resistances R^1, and on the car advancing so as to connect No. 1 and No. 24 surface rails as in fig. 5B, both magnets become short-circuited, the main arm of distributor 1 being switched off on to its insulated contact No. 25, and the main arm of distributor 2 switched on to contact No. 1, when the same actions occur as in fig. 4 A, B, C. When a distributor is switched out of gear, as distributor 2 in fig. 3, not only the main arm is insulated from the supply but the shunt arms are also, so that it is impossible for any person

FIG. 6.

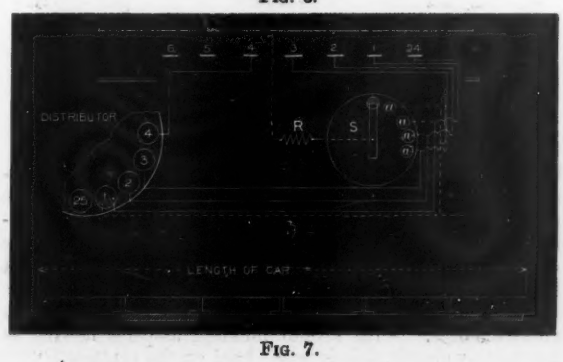


FIG. 7.

maliciously inclined to interfere with the distributors by tampering with the surface rails; also when the distributors are in action and applying current to the cars it is equally impossible to affect their action. As regards safety to the traffic, only those surface rails actually supplying current to the cars are alive that is connected with the electric supply, and as this is automatically and successfully carried out by means of the distributors in exact relationship with the advance of the tram cars, these surface rails so connected are always covered by the base of the tram cars, so that it is quite impossible for the traffic to be endangered in any way. With regard to the surface rail in advance of the one supplying current to the car the potential at this point can, by suitably adjusting the resistance R^1 and R^2 with reference to the resistance of the magnets, be brought down to perfectly safe limits. As each distributor controls a certain number of surface rails constituting a block, and only one can be supplied from same at a time, the cars are enforced to keep a certain distance apart similar to our railway block systems, which has the advantage of regulating the traffic. About 24 surface rails to each distributor is the most economical number; beyond this it will be found that the extra outlay in feeder cables is not sufficiently warranted by the reduction in the number of distributors required. The length of each block with 24 surface rails per distributor is about 135 yards, which, taking the average speed of the cars to be 7 miles per hour, would require two-thirds of a minute for each block to be traversed. Allowing, say, two blocks distance between each car, this would easily permit of a 1½-minute service. Should, however, the traffic at any part of the line require a quicker service than this, this can be arranged for by reducing the number of surface rails controlled by the distributors.

In the event of a car running into a block in which there is already a car, the supply is switched off the same, and it cannot be reconnected until the block is clear. This reconnection is carried out by means of a supplementary switch fixed underground at the junction of two blocks, and actuated by the driver. The connections of this are shown in fig. 6, which permits in this case of the supplementary switch, S, actuating the distributor over contacts 1, 2, and 3. Suppose the car, having had its current switched off at surface rail 24, is carried by its own momentum on to surface rail 2, on turning the switch arm of S on to "*a*" contact, the distributor magnet would become magnetised, and on switching it off, "*a*" then demagnetised, moving its main switch arm into contact 1. Then on further moving the switch arm of S so that it connected contacts 1*a* and 2*a* (which would make similar connections to those made by the car in passing over surface rails 1 and 2), the magnet would become short-circuited, and the main switch arm moved on to contact 2, ready for supplying current to the car. The switch, S, is so designed that while in action contacts 1*a*, 2*a*, and 3*a* are disconnected from the surface rails 1, 2, and 3, so that none of the latter while exposed can become alive. If the cars followed one another at such intervals that with care no two cars could enter the same block, the supplementary switch would not, of course, be necessary. A switch somewhat similar in action would also be used for the termini and depôt yards, where the cars would be grouped

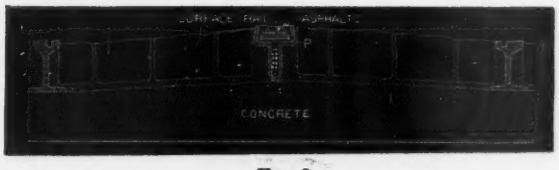


FIG. 8.

together for short distances of the line. The surface rails are about 3½ feet long, and placed at intervals of every 16 feet; this spacing of the surface rails requires 5 collectors under the cars, as shown in fig. 7. There is an advantage in using several collectors, as this means a reduction in the number of surface rails required per mile of track, and at the same time they can be shorter, correspondingly reducing the surface leakage in damp weather. As there are never more than two surface rails per car connected with the main supply (the greater part of the time there being only one), the surface leakage from these would even in wet weather be of small account, and would compare favourably with the overhead and slot conduit systems in this respect.

Figs. 8 and 9 shows the form of conduit used in this system, which consists of a rolled iron trough, the upper part carrying the surface rails bolted to creosoted wood, and the

whole embedded in asphalte, similar in composition to that which is used in paving roads, and the lower parts taking the main conductor and feeder cables. The plate, P, is laid in after the cables, and retains the asphalte. The top sides of the conduit and the surface rail being undercut, causes the asphalte to firmly embed the surface rails, the whole forming a compact and thoroughly durable form of conduit. It also has this advantage, that should it be necessary to open the same at any time, this can be done without disturbing the road surface. The number of feeder cables laid in the conduit varies from 1 to 12, and the depth of the lower part can therefore be varied to suit the number of the same. The ironwork of the conduit would break joint at short intervals,

Fig. 9.

so that no section of the same would be very well earthed, in case a connection were made between it and a surface rail by some metallic substance lying on the track during the passage of a car. It is evident that the tyres of vehicles would have no effect, as no surface rails exposed beyond the base of the cars are alive. As this conduit is only 5 inches wide by 6 inches deep, it can be laid in an existing track, without a very expensive disturbance of the road.

The following is set forth by the inventors as an approximate comparison of the various electric systems of traction, the cost in each case being per mile of single track:—

Trolley system	£1,500 to £3,000
Messrs. Pringle and Kent's system ...	£2,300
Other closed conduit systems ...	£3,000 to £5,000
Slot conduit systems	£5,000 to £10,000

The model which we inspected at Messrs. Sharp & Kent's worked admirably, and though it did not altogether represent actual conditions, it must be mentioned that the distributors were of the size that would be used on a practical system. It must be conceded to the inventors that they have very carefully worked out the details of the system, though there is a wonderful similarity between this and the system invented by M. Vuilleumier, and used at the Lyons Exhibition. We are informed, however, that the system of Messrs. Pringle and Kent is the outcome of a series of experiments made some five or six years ago in the yards of Messrs. Merryweather & Sons, Greenwich. It was sufficiently demonstrated by these experiments that no trouble was caused by dirt accumulating on the studs, the only part of the system that presented any difficulty was the distributor, and this, we are informed, has now been entirely overcome by the inventor.

STORAGE BATTERY MANIPULATION ON VARIABLE LOADS.

By J. E. WOODBRIDGE.*

Of all the places where a storage battery would seem to be desirable, the trolley line power station would appear to rank first and foremost.

The peculiar power of a storage battery for smoothing out the engine load, steadying the engine governors, the engine speed and steam distribution, carrying the station over peaks on the load curves, burning out shorts without opening the circuit breakers, tiding over emergencies, enabling a 1,000-kw. station to meet a 2,000-kw. demand, and running all-night cars unaided, should make it a blessing in the railway power house.

This blessing is pretty well disguised, at present, by difficulties of operation, which are, however, rapidly being overcome. When a storage battery is run in multiple with a dynamo on a varying load, the storage battery should be made to take a charging current when the outside load is light, and discharge the same when the load is heavy. This a simple battery will not do of itself, unless the regulation of the dynamo is very poor. If that is the case, the fall in voltage of the dynamo, as the load rises, will cause the battery to pick up a part of the load, and *vice versâ*. If the machine is compounded for constant potential at the bus bars, the battery will give the same current right along, no matter what the load is. If the machine is over-compounded, the battery will tend to discharge when the outside load is light, and charge again when the load is heavy. This will, of course, make the engine load variations worse than though no battery was used at all.

As most power stations work with over-compounded dynamos, some method has to be adopted to overcome this trouble.

The remedy used in the lighting stations is to attach a movable contact in the battery circuit for cutting in or out some of the cells. This contact may be moved by hand, or, as has been done in some Edison stations, by automatic apparatus propelled by motors, and controlled by relays sensitive to the voltage.

There are several objections to this, one of which is the well-founded objection to any form of electro-mechanical automatic regulating apparatus. Another is the trouble

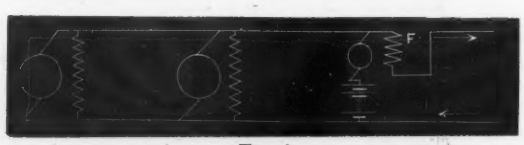


Fig. 1.

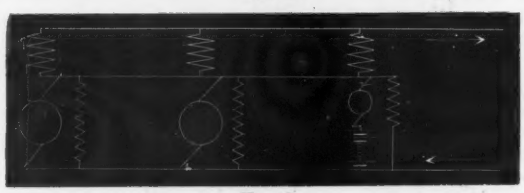


Fig. 2.

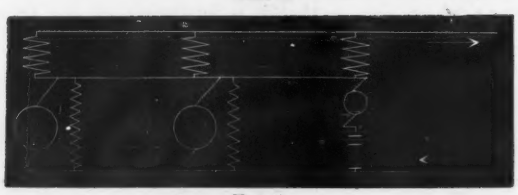


Fig. 3.

likely to result from the sliding contact. If this makes connection with a new commutator section before leaving the previous one, the cell or cells between the two are momentarily short-circuited; and if this is frequently repeated, the cells are sure to be injured. If the sliding contact does not lap over two conducting sections in the commutator, the battery circuit is opened and closed again every time the contact moves. With several hundred amperes flowing in the battery circuit, this is pretty hard on the contacts.

Another and better way is to compound or over-compound the battery circuit. To do this a special low-voltage dynamo or booster should be connected up, as shown in fig. 1, with its armature in series with the storage battery across the mains, and its fields carrying the whole outside load. Then, if the battery voltage is a little less than that of the dynamos at no load, the battery will charge when the load is light. As the load increases, the extra dynamo will automatically raise the voltage in the battery circuit and cause the batteries to discharge on heavy loads. By means of a shunt to the field (F), the compounding of the battery may be adjusted as desired.

Another arrangement convenient with compound dynamos is that shown in fig. 2. Here the battery booster has its armature connected as before, and its field shunted in with the other series fields between the equaliser and the positive bus. This extra shunt to the series coils of the dynamos will tend to reduce their compounding, but a few leaves taken out of the shunts on their terminal slates will fix that.

* *Electrical World*, New York.

Then the energy previously used in heating these shunts will go to excite the fields of the battery booster.

Still another arrangement is that shown in fig. 3. Here the battery booster is made to work both ways. A shunt winding on its field spools tends constantly to generate in its armature an E.M.F. opposed to that of the battery. The series coils on the same field tend to reverse the polarity of the machine.

When the load is light the shunt field predominates, and the booster helps the main dynamos to charge the battery. With a moderate load the booster becomes idle, but with a heavy load its polarity is reversed, and it helps the battery to discharge and relieve the dynamos.

With any one of these arrangements an adjustment of the series field of the battery booster, by means of shunts or by the cutting out of sections, will vary the amplitude of the range of the battery current. Just as in compound dynamos, a stronger series field will increase the duty of the battery on heavy loads, and a weaker field will diminish the same. Some other means of adjustment is necessary to properly proportion the charging and discharging currents; that is, to make the charging current for the 24 hours totalise the same as the discharge plus the battery losses. In the cases shown in figs. 1 and 2 this can only be done by switching in or out some of the batteries by hand. This method is open to the great objection of the automatic commutator method; that is, that some of the cells are charged differently from the others, the removable cells being at times entirely discharged or perhaps reversed, and at times overcharged, according to circumstances.

This difficulty is most beautifully overcome in the scheme shown in fig. 3. In this case the proper number of cells should be left in circuit continuously, and the adjustment made by varying the shunt field of the booster. If the battery tends on the whole to discharge, strengthen the shunt field of the booster. If it tends to overcharge, weaken the field of the booster. If only one dynamo is running, and extra work is wanted from the battery, turn down the shunt field of the booster. If plenty of machines are running, and it is decided to charge the battery in a hurry, turn the field up again, &c.

The booster should never be run from a separate engine, because at times it runs as a motor. The best way to run it is to couple it direct to a shunt motor. It will then be available, when the whole steam plant is shut down, to regulate the voltage at the bus-bars.

REVIEW.

Submarine Cable Laying and Repairing. By H. D. Wilkinson, M.I.E.E. The *Electrician* Printing and Publishing Company, Limited, Salisbury Court, Fleet Street, E.C.

Under a cover which is hardly up to either the price of this work or its merits, Mr. Wilkinson's long-expected book has at length been published. The preface states that the author has endeavoured to give a detailed summary of modern practice in manufacturing, laying, testing, and repairing a submarine telegraph cable, and a glance at the long list of distinguished engineers and electricians who have furnished suggestions and assistance, and the well known manufacturers and owners of telegraph cables who have supplied illustrations and various information make it pretty apparent that the author has had unusual facilities in the compilation of a treatise which is unique of its kind, and which should prove of the greatest value to students, and indeed to everyone interested in the subject. That it is complete the author would be the first to disclaim. The long experience gained during the last fifty years, and the history of the numerous failures which have occurred, should be carefully read up by anyone who wishes to become a master of the subject. History is a thing which is often overlooked; the beginner forgetting that a study of the experience of others, a long and tedious study as it may be, will in the end be the quickest, and that it is not how things are now done, but what led to the present way of doing things, which really is the most valuable knowledge. How often, for instance, one hears suggestions made which show unfamiliarity with history, and an ignorance of what others have done before. How many students know of the numerous inventions and devices which have been patented until they, it may be, have the same ideas occur to them, and are thus led to turn over the records of the Patent Office. But Mr. Wilkinson makes no pretence to deal with history. He has compiled an up-to-date work, and it as such that we propose to deal with it. The order in which the 57 sections come, is not, to our mind, the one which should have been adopted. Surveying the route should come first, to be followed by the design of types and the manufacture and the laying, and so on to the localisation of faults and their repair. We propose to deal with the book in this order. Pages 328 to 352 are devoted to describing the numerous kinds of sounding sinkers in general use, the steel wire employed, the machine used for its recovery, and various thermometers for the observation of bottom temperatures. Among the sounding machines is included one which is now antiquated, and might well have been left out, were it not that probably more work has been done with this kind than with any other. We refer to that shown in figs. 183 and 184. The Lucas hand machine (figs. 186 and 187), and the Johnson & Phillips steam machine for deep water, are probably superior to any other of the present day. The instructions given as being issued by the makers of this last machine certainly require revision. The writer of them has apparently not seen much deep sea sounding work. It is unusual to make splices at all in the wire nowadays, because, as is mentioned on pages 94 and 328, lengths of about 7,000 fathoms are now obtainable. The original system introduced by Lord Kelvin of always balancing the weight of wire out board, when paying out, by constantly adding weight on the brake so that the drum stops immediately on the sinker striking ground, has long since been discarded; experience has shown that if the sinker employed is heavy enough to carry the wire down at a brisk rate, the striking bottom can always be detected. Consequently, it is not now of importance to have the drums carrying the wire as light as possible, and they are made of such strength that the wire can be coiled direct on to them under strain, without any ill effects. There is no need, either, to place the drum overhanging the water when paying out, as in fig. 183. Indeed, it is far better placed well inboard, so that there is a good length of wire between it and the ship's rail.

Buchanan's water and mercury piezometers are carefully described, as also are various other instruments used for ascertaining the temperature of the water. A page or two of matter connected with surveying has somehow got mixed up with "slipping splice," page 93, and the various forms of logs, including the admirable arrangement devised by Captain Thomson, R.N.R., are dealt with in the chapter on Laying Main Cable, page 367. These, together with James's submarine sentry, should certainly be included under the surveying of the route.

(To be continued.)

CORRESPONDENCE.

Electricity Meters.

In No. 925 of your journal, dated June 22nd, you publish an article concerning electricity meters, which appears to be identical with the views shared on this subject by the leading central station engineers.

Though no sacrifice of time or money has been spared during more than ten years, in the endeavour to produce a meter, which is absolutely reliable and at the same time easily managed, from the point of view of central stations, of the consumer, the Board of Trade and manufacturer, the success attained has been little encouraging, the best proof of the difficulties by which this all important question is beset.

The very first meter that was introduced into this country, as a really practical electricity meter, was the Aron meter. You state quite correctly that so far as correctness is concerned it left little to be desired, yet the fact that it has to be wound once a month, that the clockworks were not all too perfect

at the commencement, and that it cannot be sealed up and sent out without being re-regulated when first put in operation, have been sufficiently strong reasons to give other meters a trial which seemed to cause no such mechanical inconveniences.

In its place appeared the mercury meters, but experience with them proves that they neither obtain the expected standard of perfection, and the same may be said of the motor meters.

Even the alternating current meter that has been passed by the Board of Trade (the Shallenberger) has been disappointing.

As a proof of this, we need only cite that the very same meter that is put in one central station to replace another, is at some other station meeting with a reverse fate.

We cannot but admit that what you point out with regard to the mechanical imperfections of the Aron meter have in reality existed years ago; but, in the meantime, while this meter was for a time pushed from the English market on account of these inconveniences, it has, by years of experience, been improved in every part. Most attention has been paid to the finishing of the clock works, which are now working with such accuracy and perfection that stoppage is almost impossible; the construction of the cases and coils has also been improved.

The use of the synchronising arrangements greatly simplify the regulations, and entirely avoid the small errors and differences formerly caused in the intervals when there was no consumption of current.

In the meantime, the Aron meter has on the Continent had an unchecked career of progress and success; about 80,000 of its type are at the present time in use in Europe.

In the watt-hour meter of recent manufacture, the use of all variable elements are avoided, as the meter does not contain any magnets that are liable to variation. The total resistance varies according to the size of the meter, but is in a 25-ampere meter about 10,000 ohms. The current consumed in the shunt, therefore, can be considered as negligible.

Without any adjustment, the watt-hour meter may be used for either direct or alternating currents, its constant reading being independent of the periodicity of the generator. The reading of the watt-hours consumed is direct in Board of Trade units.

If the question arises, shall we adopt a meter which gives the most satisfactory results as to its proper working and correct reading throughout the whole range, but has the little inconvenience of having to be wound up once a month, or one that does not present this inconvenience but which does not measure correctly or consumes too much current, or gives other troubles, we should think the answer would be in favour of the Aron meter.

The General Electric Company, Limited.

Electrozone.

Is electrozone a product of sea-water and electricity? Then it is simply a mixture of hypochlorite of sodium, magnesium, &c., formed by one of the well-known electrolytic processes, and does not, and cannot contain, the slightest traces of ozone.

Electrozone, minus electric current and minus ozone, would be the liquid which Labarraque made known 70 years ago, *i.e.*, hypochlorite, the liquor sodae chlorinatae, which every apothecary will prepare *secundum artem*, and sell much cheaper than electrozone, which costs 1s. per quart, or meditrina (medical electrozone), which retails at 2s. 6d. per bottle.

Despite its high sounding title, "Electrozone," the presence of ozone in this universal disinfectant is evidently somewhat hypothetical, and until the British Electrozone Corporation has proved that there is really some ozone in it, I must decidedly opine that electrozone is a misnomer. Ozone, combined with hypochlorite, may, of course, make a good compound for disinfecting purposes; but if electrozone, without ozone, is merely a mixture of hypochlorites, will it annihilate disease germs, or deodorise better than the electrolytic hypochloride manufactured by the Hermite International Electrical Sanitation Company, Limited?

E. A.

Non-Magnetisable Watches.

I shall be obliged if you will inform me what constitutes a "non-magnetisable" watch. I bought an expensive chronograph from a well-known firm, and paid about £2 extra for having it rendered non-magnetisable, but it repeatedly stopped when near a machine, though the rate was not afterwards affected.

On complaining, they sent me down an iron overall case, which makes the watch a veritable "turnip," but prevents it stopping. Am I liable to pay a guinea which they claim for this case?

J. W. M.

[We should say decidedly not. We would suggest returning the watch and claiming the full amount, assuming that J. W. M. has documentary evidence at command to support his case.—Eds. Elec. Rev.]

Note on "The Jacques Carbon Generator."

In the notice of this oddly-named voltaic arrangement commencing on p. 826 of this journal, Prof. Rowland is reported to have made certain statements which appear open to criticism. In the first place, Dr. Jacques has not shown "how the oxygen of the air, or free oxygen, may be made to combine with carbon to produce electrical energy, nor are there any grounds for supposing that any *direct* combination of the kind could possibly result in a voltaic effect. And, in the second place it is very doubtful whether any "practically operative process" has yet been arrived at; although many processes of theoretical and scientific interest have from time to time been experimented upon for many years past.

In this connection the following extract from a letter which I received 13 years ago from a very distinguished investigator may be of interest.

Athenæum Club, Pall Mall,
March 3rd, 1883.

Dear Mr. FitzGerald,—In consequence of what you said on Sunday, I tried the experiment again with iron and carbon in fused caustic soda. There was a good current; but I came to the conclusion that the heat required would be too high, and the soda too costly, to make the current an economical one. So the Frenchman is welcome to it.

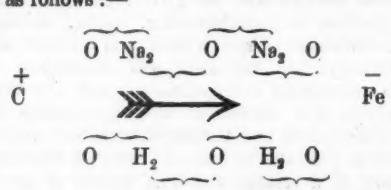
Believe me,
Very sincerely yours,
William Crookes.

I think it is a mistake to suppose that any carbonic acid gas "escapes in bubbles" from the sodic hydrate or that "the composition of the latter is not modified" by the production of alkaline carbonate. My experience is that *all* the carbonic acid produced is absorbed by the alkali. But, in a scientifically constructed apparatus, the carbon should be as much as possible protected from contact with oxygen (which can only consume it in waste); the stream of air being confined to the cathode (iron) surface.

The following electro-chemical equation is probably applicable to the arrangement, so far as it constitutes a voltaic cell:—

$$2\,(Na\,HO) + C + 2\,O = Na_2\,CO_3 + H_2O.$$

And the electrolytic reactions would appear to be those indicated as follows:—



Desmond G FitzGerald.

Leeds Electric Tramway Contracts.

One is naturally somewhat loth to publicly criticise estimates coming from any of the eminent firms that have quoted for the various contracts under Dr. Hopkinson's specifications for the Leeds Electric Tramway, but I feel obliged to enter a protest—both on behalf of the public and the electric traction interests themselves—against the figure quoted for the overhead work and return circuit being accepted as in any way representative of what the work really costs.

It would indeed be a bad look out for real satisfactory progress in electric traction if municipal authorities and tramway companies at large were to regard the Leeds tenders in this particular respect as authoritative and reliable: so far from this being the case, I feel convinced that the bare cost of material alone would amount to more than the total sum quoted in the tender recommended for acceptance under this head, viz., £3,370. This statement may easily be verified—or contradicted.

Fourteen miles of No. 0000 (·4 inch diameter) copper wire, weigh nearly 37,000 lbs., and the present price of copper does not give much change out of £1,000 for this quantity. Then the total length of rail amounts to about 49,400 yards, so that with an average length of rail equal to, say, 6 yards (including curves, junctions, cross-overs, &c.), there would probably be at least 8,000 joints or 16,000 bonds.

Chicago bonds of the type specified cost all of 3s. each, fixed in position, including labour and plant; consequently, a total of £3,000 odd is soon reached, without considering the cost of erecting trolley wire with insulators, span wires, guy wires and guard wires, much less the 350 cross-bonds required on the track, or "engineering and contingencies."

I feel pretty sure that most of those who by actual experience are fully cognisant of what such work as this really costs will agree with me in saying that the lowest figure at which Dr. Hopkinson's specification can be adequately satisfied, without loss to the contractor, is at least £5,000; and I would almost be willing to wager that the unsuccessful tenders rise above this amount nearly in proportion to the length of line equipped, and the consequent experience gained by the respective firms or companies tendering.

It will, I trust, be understood that there is no personal feeling in the matter whatever. I am—as you are aware—absolutely independent of any of the competing firms, and merely call attention to the subject in order to prevent, if possible, the same excessive cutting of rates in electric traction that we have experienced in electric light work. The days of doing work at a loss in order to get contracts ought to have passed by long ago. I can hardly imagine this to be the operative cause in the present instance, but the precedent ought not to be followed. That the tender will prove to have been founded on a misunderstanding is the most desirable and most charitable conclusion.

K. N. A.

[Our correspondent will be interested in perusing the estimates for this work in our "Traction Notes." He will find that the tender to which he alludes has been withdrawn.—Eds. Elec. Rev.]

The Langdon-Davies Motor.

Referring to the tests of a three-phase motor given on page 821 of your last week's issue, and compared with the tests made by Prof. S. P. Thompson, F.R.S., of one of my motors, I think it should be pointed out that the periodicity at which the tests of the three-phaser were made was 50 ~ per second, whereas in the case of my machine the tests were made at 83 ~ per second; the advantages in favour of the three-phaser will be readily understood by "those well skilled in the art," to put it in the language of patents.

W. Langdon-Davies.

Being much interested in alternating current motors, I devoured your notice of the above with eagerness; but I am not greatly satisfied with the meal. A huge amount of painstaking, thought, and mathematics seems to have been expended upon the special features of the design; but, after all, is not most of it, for practical purposes, superfluous? For instance, as to the method of winding, fig. 1, and the deductions drawn therefrom, are very true *when* the rotor is absent. But with this in place, the magnetic reluctance along the various paths will not vary at all in the manner stated. In fact, there is scarcely likely to be more than 20 per cent. or 25 per cent. difference between the reluctances of the longest and shortest paths; unless the induction is very high. This arises, of course, from the greatly preponderating reluctance of the air gaps, which is sufficient to secure a uniform distribution of the field without the aid of special windings. It results that in these motors the magnetic flux at any point must be nearly proportional to the ampere turns effective thereat. Therefore, in the Davies motor, as in the Brown or common form, but in a less degree, the flux must be greater about the line N, S, instead of being evenly distributed. But why is an even distribution desired?

Again, as to the starting coil, I cannot think the method of finding the position of the coil to give a constant rotary field will be new to anyone who has given much thought to polyphase problems. Mr. Davies may be the first to publish it; but it seems to me too obvious to have remained unnoticed so long. And it is an interesting point whether the constant rotary field he obtains gives a better starting torque than the pulsating one, resulting, when the coils are put at right angles, say, instead of at the angle supplemental to the phase difference between the running and starting currents.

The method of starting, requiring resistance only, is a really good and practical one, though the phase difference obtainable is rather limited. The strength of the rotary starting field is proportional to the sine of this phase difference.

While I take exception to these points in Mr. Langdon-Davies's design, I think he merits our best congratulations for the energetic way he has brought *English* enterprise to bear on this question.

James Whitcher, A.Inst.E.E.

Alternate Current Transformers.

My notice has been brought to a statement from Messrs. Johnson & Phillips in your issue of two weeks ago respecting the above, a statement no doubt born of a notice of ours in the preceding week.

I shall be glad if I might say that we have no intention whatever of infringing anybody's rights or patents that may be legitimately existing for transformers or any other appliance; least of all have we any intention of giving umbrage to firms with whom we are on such good terms as Messrs. Johnson & Phillips.

Our remark as to our new works' manager having been long associated with Mr. Gisbert Kapp, was only meant to convey a certain amount of guarantee of our fitness to produce these important appliances, and not that we intended copying any design of Mr. Kapp's which may be the property of Messrs. Johnson & Phillips.

In the race for the living wage "fresh fields and pastures new" have to be sought, and though bound to exert every energy, we shall certainly not encroach on any legitimate preserves.

W. M. Menzies, *General Manager,*
The Consolidated Telephone Construction and Manufacturing Company, Limited.

Patents in Russia.

It may be of interest to your readers to know that the present law regarding patents for invention in Russia has been superseded by a new Act sanctioned by His Majesty the Emperor on May 20th (June 1st), 1896, and which is to take effect on and after the 1st (13th) July. Its provisions are, briefly, as follows:—

Patents are granted to first applicants for a term not exceeding 15 years, limited by prior foreign patents if such exist.

The fees on application are very materially reduced, and progressive yearly taxes, increasing to a considerable amount on the later years of the patent, are substituted.

A preliminary application is to be made in the first instance, and completed or amended within three months; protection dates from the day of application.

Patents may be opposed within two years after publication on various grounds. After the expiration of this term a patent can be contested only in the law courts.

Patented inventions must be worked in Russia within five years of the date of application.

Applications now pending will receive the benefit of the new law, and patents granted and still in force may be prolonged up to 15 years on payment of the requisite annuities.

These provisions appear so much more liberal than the terms of the existing law, that they will, without doubt, be welcomed by patentees.

W. P. Thompson & Co.

THE ELECTRIC v. THE HYDRAULIC ELEVATOR.

Mr. Baxter, whose articles on "Electrical Working of Railways," and other electrical applications, we have had occasion to notice, has also directed his attention to electrical elevators. Those who know the elevator as applied to high buildings in America, will appreciate that in competing with hydraulic driving, electricity has got to compete with an agent, the result of which, to the public at least, is extremely satisfactory. He reviews the case for the electrical elevator, and points out how old buildings of the office type have been superseded and rendered useless by new buildings with elevators. Now, many old buildings cannot be fitted with hydraulic elevators because of the absence of space for the hydraulic machinery, and Mr. Baxter is speaking of America where hydraulic power is not laid on as it is in London or Manchester, but where electricity is almost everywhere at hand. Given, therefore, room for the elevator, and there at once is a field for electrical driving of the same. It was the builders of hydraulic elevators who really introduced its electrically-driven parallel in 1888, in order to cope with the old buildings difficulty, but they looked on electricity merely as a makeshift. It was a case of Hobson's choice, that or nothing. Those now engaged in the making of electrical elevators have different views. They consider the newer machine to be already better than the old one, and to be a distinct competitor. Mr. Baxter, however, awards the palm to the hydraulic machine for ease of control, though he thinks this need not be the case, and that in other respects the electrical machine is superior. In comparing the two, we have on the one hand the efficiency of the steam pump, the transmission and transforming apparatus, to compare with the steam engine, generator and electric transmission and transformation. Obviously the greater number of transformations, electrically, will be more than balanced by the superior efficiency of the engine over the steam pump, and generally the less frictional or transmission losses in electrical working. In hydraulic transmission at high pressure, piping must either be small and strong, or large and expensive. But the pressure tank in the hydraulic system enables, by its storage capacity and equalising effects, the pump to work at best efficiency and uniformity. The pump can, in fact, be equal simply to the average demand for water, not to a maximum.

The electrical elevator, on the other hand, lacks any storage system. For a single elevator, therefore, it is claimed that, on a mere matter of power for a given duty, both systems are much on an equality, an equality, however, which disappears in favour of electricity when two or more elevators are used, and there are few large office buildings with less than four elevators at work, about one elevator to 70 rooms being probably a frequent provision, and many buildings having five, six, and even eight cars. While there are losses in the electrical system through inefficient action of the motor at slow speeds as when starting, for instance, it must be noted that in the hydraulic system the energy must be sufficient to start a car at a fair speed, and this same rate of energy consumption is necessarily continued throughout the whole course.

There is a good deal of trouble with the counter-balancing of elevators, especially for high speed working, because of the momentum of the car and balance weights, and the necessity of not checking the lifting ropes more quickly than gravity will bring the car to rest, otherwise the car will overrun and fall back.

An electric elevator balanced at the drum will behave as though not balanced at all, and the danger of rope slackness would be minimised. Directly counterbalanced cars cannot therefore be fully balanced, by a long way, for high speeds, and hence the efficiency as compared with machines of drum type decreases as speed increases.

As regards control, the hydraulic elevator is controlled by a valve which shuts up an incompressible liquid, and a skilled operator can adjust the stoppage of the car to a nicety, and a too sudden stop is avoided by the action of a release valve. With electrical working stoppage is effected either by a friction brake or by reversing the motor, or by a combination of these two means. Mr. Baxter says, however, that already only an expert could detect the difference between the two stoppages. Whatever its objections, also, the electrical system demands no objectionable hand rope. Nothing but a small switch box appears on the car. With hydraulic elevators, machinery to generate pressure is necessary in the building itself. If electric elevators are employed, the current may come direct from the street mains with the lighting current. The economy or otherwise of this must depend on the dimensions of the building. Many owners would prefer not to have the trouble and risks of steam boilers in their basements. For such the electric elevator will be welcome, and this cause alone may give the turn in favour of electricity in cities where this reason holds good, which, of course, it cannot do where hydraulic power is laid on as well as electricity. All the arguments in favour of electric driving are based on the drum machine. Some makers of electric elevators, however, prefer the horizontal screw type of machine, in which we believe a screw takes the place of the hydraulic piston, and the rest of the gear is of the multiple rope type common to the American elevator, and in this respect, therefore, the question of balance will remain equal for the two systems. For our own part we should certainly expect the screw machine would prove the better.

BUSINESS NOTICES, &c.

Electrical Wares Exported.

Week Ending June 30th, 1896.	£	s.
Adelaide	27	0
Albany. Teleg. mtl. ...	1,374	0
Amsterdam	75	0
Antwerp	42	0
Baltimore. Teleph. mtl.	28	0
Brest. Teleg. mtl. ...	2,500	0
Calcutta	25	0
Cape Town	18	0
Colombo	76	0
Delagoa Bay	175	0
Durban	1,175	0
Flushing	198	0
Gothenburg. Teleg. wire	83	0
Lisbon	15	0
Melbourne	388	0
Mozambique. Teleg. mtl.	17	0
Ostend	372	0
Port Darwin. Teleg. apps.	150	0
Port Elizabeth ...	1,564	0
Port Said	66	0
St. Helena	8	0
St. Petersburg	55	0
Singapore	16	0
Stockholm	35	0
" Teleg. mtl....	175	0
Sydney	499	0
Valparaiso	100	0
Wellington	44	0
Total	£9,300	0

Week Ending June 30th, 1895.	£	s.
Amsterdam	20	0
Bangkok. Teleph. mtl.	68	0
Bombay	35	0
" Teleph. wares...	29	0
Buenos Ayres Teleg. mtl.	167	0
Calcutta	535	0
Cape Town	157	0
Delagoa Bay	140	0
East London	241	0
Lisbon. Teleg. cable ...	129	0
Melbourne. Teleg. mtl.	490	0
Nagasaki	144	0
Otago	435	0
Riga	49	0
Saigon	439	0
Shanghai	45	0
" Teleg. mtl. ...	20	0
Stockholm Teleg. wire	57	0
Sydney	81	0
Total	£3,281	0

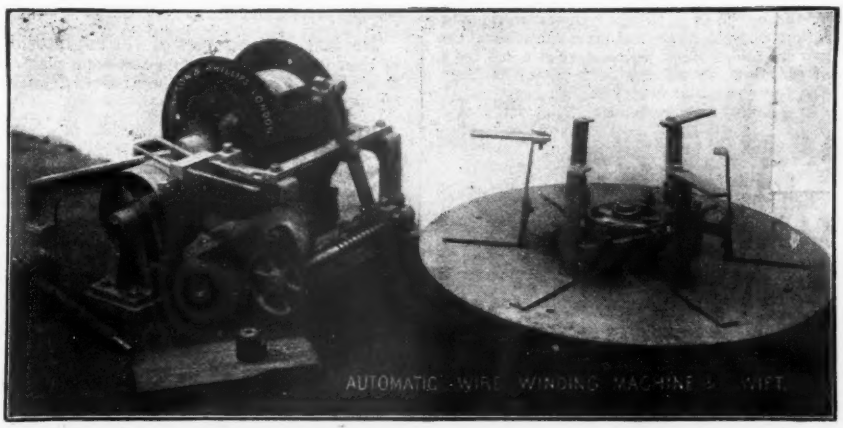
Foreign Goods Transhipped.

	£	s.
Adelaide. Teleph. mtl.	14	0
Sydney. Teleph. wire...	40	0

A Good Year.—Messrs. Shuckert & Co., of Nuremburg, report a profit of £172,241 for the financial year 1895-96, as compared with £116,197 in 1894-95.

Dissolution of Partnership.—Mr. F. C. Allsop informs us that he dissolved partnership in April last, and is now carrying on business entirely by himself as in former times. His new City offices are at 97, Queen Victoria Street, E.C. The new works at Clerkenwell are equipped throughout with the most modern machinery.

Automatic Wire Winding Machine.—Messrs. Johnson & Phillips, who are well known for their cable making, wire-winding, and similar machinery, have just made a machine for winding steel wire on to bobbins, ready to be placed in the stranding machine for the purpose of laying up the wires to form the ropes. As the ropes are composed of a great number of these wires, it will be evident that in a wire rope factory there are a great number of these bobbins to be wound, and the old custom is to have a man or lad to each bobbin, his duty being to guide the wire on to the bobbin by means of a hand lever. This necessitates a large amount of labour, and one object of the automatic machine is to reduce this labour to a minimum. It is claimed that various difficulties are overcome by the machine which we now illustrate. The wire is automatically guided on by the rocking arm actuated by the double right and left hand screw sheave. The wire is kept tight on the bobbin by means of a hard wood "bat," which is arranged to keep a constant pressure on the surface of the wire as it is wound. On some machines the makers arrange this bat to put the bobbin out of gear when it is full, but this is not the case in the machine illustrated. This machine is suitable for numerous sizes of bobbins and wires, the traverse arrangement can be varied to suit the different sizes of wires, the bobbins can be rolled into and from their places, and it is therefore very useful and convenient. An accessory to the above is the swift on which the coil of wire to be wound is placed. Our illustration shows a rather novel swift, inasmuch as it can be readily adjusted to suit different diameters of coils of wire. The body is formed of six radial arms, which are provided with rack ends actuated by means of a geared wheel. The coil of wire being placed on the swift, the arms are expanded by means of a key until the coil is tight, and the arms are locked in position by means of a thumb screw. The bobbin part of the swift is provided with a friction ring and strap, by means of which a steady tension is always kept on the wire, and the swift prevents from over-running. The advantages of this combination of machine and swift, are that one winder can attend to several machines, and that the bobbins are wound evenly and tightly.



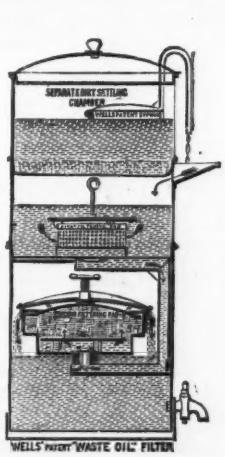
Belliss Engines.—A new list (June, 1896) of patent self-lubricating, high speed electric light engines, has been issued by Messrs. G. E. Belliss & Co., Limited, who have found this department of their business so successful, that they have been obliged to greatly extend it, and add a very complete new testing house, to enable dynamo machinery of all sizes to be thoroughly tried under working conditions before being despatched. We understand that the firm has already built, or has at present under construction, engines of their self-lubricating type engine, developing nearly 30,000 H.P. The list which we have before us gives a description of these engines, and specially deals with the working and testing of dynamo machinery, these comments being illustrated by means of a photograph of the test-house referred to above. There are a number of good illustrations of combined plants, also a number of testimonials and general remarks regarding the business. The list is nicely prepared.

Cardiff Exhibition.—At this Exhibition Messrs. W. T. Glover and Co. exhibit specimens of telegraph, telephone, and electric light wires, in India-rubber and gutta percha insulations; also cables insulated with "diatrine," armature bars, and Wordingham's patent "pillar distributor," which we describe elsewhere in this issue. This firm supplied all the cables and wires for lighting the Exhibition. Machinery for the transmission of electricity for mining and various other industrial purposes is shown by Messrs. Easton, Anderson and Goolden, Limited. A model coal mine includes a pump driven by an electric motor. The Atkinson-Goolden electric coal-cutting machine, and "Niagara" pulverisers, driven by electromotors, also form part of this exhibit. Messrs. Siemens Brothers have on exhibition a model of the cableship *Faraday*.

Dissolution of Partnership.—The action of Bennett *v.* Druce, which came before Vice-Chancellor Hall, Q.C., at Manchester, on 26th ult., was a motion on behalf of Frederick Francis Bennett, of Preston, for the appointment of a receiver and manager of the partnership business carried on by the plaintiff and William Haviland Druce, of Preston, and 33, Brazennose Street, Manchester, as electrical engineers, under the style of "Bennett & Druce," at Preston. Mr. Mansfield, who appeared in support of the motion, said a writ had been issued on behalf of the plaintiff claiming a dissolution of the partnership, which was entered into in 1893 for 10 years, that the defendant should be ordered to make good certain losses, damages for injuries to the partnership business by reason of the defendant's misconduct, and the appointment of a receiver and manager. The present application was for the appointment of Mr. James Todd, chartered accountant, Preston, who had acted as auditor of the partnership affairs, as receiver and manager. Both parties had nominated the same gentleman for appointment as receiver. Mr. Eastwood, who represented the defendant, said that after the commencement of the first action the parties met privately, and negotiations were entered into for a settlement of the differences. These negotiations were only abandoned a few days ago, and as it was found the plaintiff had paid partnership moneys into his private account, notice of motion was given for a receiver. The parties having agreed to treat the motion as the trial of the action, the Vice-Chancellor gave judgment dissolving the partnership, directing the usual accounts to be taken, and the partnership assets to be sold, and appointing Mr. Todd receiver and manager, costs to be reserved.

The Royal Visit to Cardiff.—Their Royal Highnesses the Prince and Princess of Wales, and the Princesses Victoria and Maud, visited the electric light installation at the Cardiff Exhibition on Saturday afternoon. The Royal party took great interest in the electric lighting plant, which Messrs. Strode & Co. have erected for the purpose of lighting the Exhibition, and the Prince accepted a portable electric battery and lamp mounted in a silver case, which Mr. Strode presented as a souvenir of the Electric Lighting Section of the Exhibition.

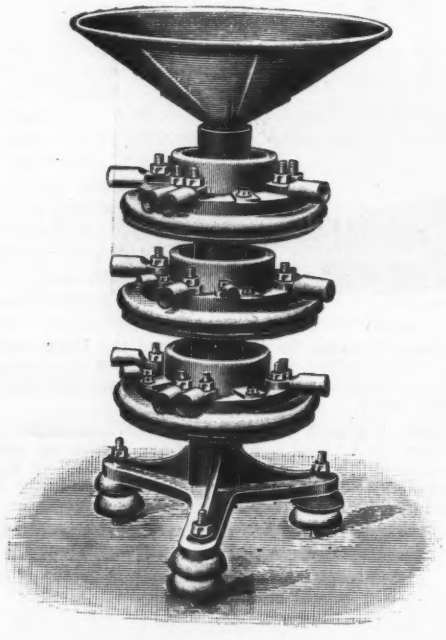
Wells's "Waste Oil" Filters.—We illustrate below Wells's new patent "sight-feed syphon" filters which are being used in connection with a number of electric light installations, and have been supplied by Messrs. A. C. Wells & Co. to gas-engine makers, mills, factories, &c.



By means of these filters it is claimed that the smallest user of steam or gas engines and other machinery can save dirtied oil, which, in most cases, is thrown away to waste. This may be cleaned in these filters, and used again and again, effecting a considerable saving, and very soon paying for the first outlay. The construction is very simple, all parts being easily accessible for cleaning. The filtering pads can be quickly and cheaply renewed. With the sight-feed syphons it is claimed that the best surface of the oil only is syphoned over to the filtering pads, giving time for the dirt and water to settle naturally to the bottom of the collecting chamber.

The Jandus Arc Lamp.—We understand that over 700 Jandus arc lamps have been supplied from the English works, although they have only been in full swing for a few months. Messrs. Drake & Gorham, who are the sole agents, have opened a branch at Glasgow for the convenience of contractors in the district.

Wordingham's Pillar Distributor.—Most engineers are agreed that it is desirable to inter-connect a distributing network at as many points as possible, in order chiefly to equalise the pressure. If this inter-connection is well carried out, it further enables smaller feeders to deal with the constantly shifting area of maximum demand. The great drawback to such inter-connection is the difficulty of localising a fault should one occur, and with a view to providing for this, it is essential that all linking points should be capable of rapid disconnection. This is by no means easy to provide for in a neat and convenient manner when there are many cables meeting in one point, say where four streets meet, and the difficulty is very largely increased when the distribution is effected on the five-wire system, since the number of cables is largely augmented. The necessity for some convenient apparatus of high insulation for the purpose named, led Mr. C. H. Wordingham, chief engineer to the Manchester Corporation electric works, to devise the apparatus illustrated in this issue, to which he has given the name of "Pillar Distributor." A central hollow cast-iron column standing on three oil insulators is fixed in the junction box. From this column project at five different levels three cast-iron lugs, 120° apart, cast in one with the column. Five cast-iron plates, each having three slots separated from one another by 120°, and three recesses on the underside placed between the slots are provided. One of these plates is slipped over the pillar, the slots allowing it to pass the lugs until the bottom three lugs are reached. The plate is then turned through an angle till the recesses are opposite the lugs. The plate is then dropped down, and takes a firm seat. On the plate are placed two flat rubber rings, which serve as a bed for a porcelain insulator of the form shown. This insulator is large



enough to slip past the cast iron lugs. Three slate wedges covered with India rubber strip are placed between the insulator and the pillar, so that the insulator is firmly fixed. A substantial ring of gun-metal is now placed on the insulator. This ring is prevented from slipping about by means of four small brass pieces, secured by bolts, and rendered adjustable by means of slots. This ring has studs and tapped holes, which admit of a large number of lugs, into which cables are sweated, being affixed to it by means of nuts and bolts. A second cast iron plate is now slid down the pillar and fixed on the next three lugs from the bottom, and an insulator and ring placed on it as before described. Three more cast iron plates, each with its insulator and ring, are then fixed on the remaining lugs. A large funnel is slipped on to the top of the pillar. This serves to collect any water that may drip into the junction box, and so prevent it from falling on the apparatus; the water runs down the funnel through the interior of the column. The illustration shows the apparatus complete, without any cables attached. Such a pillar distributor is capable of dealing with a very large number of cables. Each ring can readily have 6 half-square inch cables and six smaller ones attached to it, that is to say, the pillars, as a whole, will deal with 70 cables. A considerable number of these distributors have been introduced into the Manchester network with the most marked success; indeed, they are being placed at all important points of intersection. It is quite easy to disconnect the five cables which pass down a street in as many minutes, and, in case of a fault, portions of the network from which a large supply is being taken can be broken with perfect safety. On one occasion as much as 1,700 amperes at 200 volts was successfully disconnected on one of these pillars. Messrs. W. T. Glover & Co. have the sole right of manufacturing these distributors. Samples may be seen at their Salford works, or at their offices, 39, Victoria Street, Westminster. They are also shown at the Cardiff Exhibition.

ELECTRIC LIGHTING NOTES.

Aberdeen.—The interior of the Advocates' Hall Buildings, Aberdeen, is being fitted up with the electric light by Messrs. Shirras, Laing & Co. The hall will be lighted with 33 pendants, each of 25 candle-power, the library with 32 lights, each of 32 candle-power, the committee room with a 5-light electrolier, and the reading room with two 3-light fittings. The other apartments, corridors, &c., are also fitted up.

A sub-committee is considering upon what terms the Corporation can supply electric light for the harbour.

Bath.—A Select Committee of the House of Commons has confirmed the provisional order which authorises the Corporation to undertake the electric lighting of the city.

Bearpark.—The Broom Parish Council visited Bearpark last week to inspect the plant which has been laid down by the Bearpark Coal and Coke Company, for lighting their large and commodious works, and also the village.

Belfast.—The report of the engineer on the combination of electric lighting and refuse destructor plants, as found in certain English towns, was read to the Electric Committee last week. The report is to be printed.

Bolton.—Mr. W. H. Angus, of Newcastle-upon-Tyne, has been appointed assistant electrical engineer to the Bolton Corporation at a commencing salary of £110 per annum. There were 56 applications for the post, and six of these were selected to appear before the committee having the appointment in hand. The demand for the electric light within the borough is such as to induce the Corporation to go in for an important extension of the mains. In view of certain complaints and inquiries from intending consumers, the Gas and Electric Lighting Committee have passed the following resolution:—"That for specifications for electric work, prepared by the electrical engineer at the request of intending consumers, a charge of £1 1s. be made when the installation does not exceed 50 lights, and £2 2s. when the lights are above that number." It was further resolved that, when the engineer superintends the work undertaken by firms other than the Corporation, a charge of 5 per cent. on the cost be made.

Bristol.—The Electrical Committee have approved the reports and plans of their engineer and architect for the extension of the station at Temple Back in order to meet the increasing demand for private lighting. A sum of £75,000 more capital has been sanctioned by the Council, and when the Local Government Board intimate their concurrence, the works, which include a good deal of piling and a large chimney stack, will be undertaken.

Cardiff.—Owing to a slight mishap at the central station, the lamps in the principal streets of the town were extinguished last Saturday night.

Dublin.—Replying to Mr. Horace Plunkett in the House of Commons the other day, Mr. Ritchie said: By a provisional order under the Electric Lighting Acts, 1882 and 1888, confirmed by Parliament in 1892, the Corporation of Dublin were authorised to supply electricity in the city for all public and private purposes. The attention of the Board of Trade has not been called to any case in which there has been delay in meeting a demand. The Corporation are, on a requisition from owners and occupiers of premises, bound to give them a supply within a reasonable time under the conditions specified in the order. If the requisition is not complied with, the Corporation are liable to penalties, which may be recovered in a Court of summary jurisdiction.

East Hanningfield.—The Rectory is now lighted by electricity, supply being taken from a Crompton dynamo driven by a pair of Davey, Paxman & Co.'s engines, which plant also furnishes light for the mills. There are 40 lamps in the rectory.

Exeter.—The Special Committee on Lighting have presented a report to the Council, in which they express the opinion that it would be advisable that in addition to the Council supplying the light, they should be in a position to instal and repair electric light fittings in the houses of their customers. It is recommended that the works should be considered as one of the departments of the work of the Council under the control of the surveyor; that an electrical engineer be appointed in charge of the works, who shall be responsible to the City Surveyor for the conduct and work of his subordinates; that Mr. Munro, the present electrical engineer to the company, be appointed electrical engineer at a salary of £200 per annum; and that the following staff be also appointed:—Leading engine-man, £2 per week; second engine-man, £1 10s.; three stokers at an aggregate of £3 12s. per week; foreman jointer, £2 2s. per week; four electricians at £70, £60, £52 and £52 per annum respectively. The report was considered at a special meeting of the Council, and it was decided that the old staff should be retained rather than make new appointments of men who were not used to the station.

Treasurer be authorised to receive a sum of £11,000 at £3 per cent. interest, being the amount sanctioned by the Local Government Board for the purchase of the undertaking and the extension of the works of the Electric Light Company, such loan to be subject to six months' notice on either side.

Fermoy.—A public meeting was held the other day to consider an offer made by Mr. F. J. Warden-Stevens regarding the lighting of the town. He said he had inspected Fermoy, and conferred with the Town Commissioners respecting the introduction of the electric light. A circular was sent out in order to ascertain the probable number of lights that might be required, and asking that the accompanying form should be filled up. If the result obtained was sufficient to justify electric light works being started, a private company would be formed for the purpose, the consent of the commissioners having been obtained. The meeting approved of the offer subject to certain conditions.

Folkestone.—The Town Council has appointed Dr. Hopkinson to investigate the agreement to be made with Mr. Hopkins for the sale of the order.

Glasgow.—The *Glasgow Herald* says that the Electric Light Committee has decided to recommend that the price of the electric supply be reduced in accordance with a new scale. A new meter, which is expected to suit better than the present arrangement, is also likely to be adopted.

Hampstead.—Lyndhurst Road Congregational Church is shortly to be lighted by electricity, at a cost of £450.

Hull.—The Finance Committee has decided to apply for sanction to borrow the £42,000 necessary for electric lighting extensions.

Kingswood.—The Western Counties Electric Lighting Company has informed the Council that if they are going to do anything in the matter of purchasing the electric plant they must do it at once. The matter must be brought to a finish. Following the advice of their solicitor, the Council decided to leave the matter in abeyance.

Leicester.—The Board of Guardians has decided to light the Board Room by electricity, and estimates are to be obtained for the work.

Liverpool.—On Wednesday the undertaking of the Liverpool Electric Supply Company, Limited, was formally taken over by the Corporation, who will in future supply electricity to the public.

On 25th ult., a Committee of the House of Commons ordered to be reported for third reading the Electric Lighting Provincial Orders Bill, relating to the supply of the electric light by the Liverpool District Electric Lighting Company to Allerton, Little Woolton, Much Woolton, Childwall, and Garston.

London.—Kentish Town Church is to be closed during August to allow of renovation, and the introduction of the electric light.

Manchester.—The Electric Lighting Sub-committee, in their annual report, state that the number of consumers at the close of the year was 1,148, being an increase of 407 as compared with last year. The net surplus profit for the year is £11,138. The demand for the supply of the electric light continues to be so great, that further extensions are imperatively necessary, and it has been decided to lay them in the following streets:—Great Ducie Street and Bury New Road, Miller Street and Great Ancoats Street, Corporation, Lower Mosley, Grosvenor, Upper Brook, Great Jackson, and Upper Jackson Streets, Victoria Park district, and Ardwick Green. Application has (as already stated) been made to the Local Government Board for permission to borrow £100,000 to carry out the extensions, which are expected to be partly available for the ensuing year.

Merthyr Tydfil.—A provisional order entrusting the electric lighting of the district to Mr. J. C. Howell, has been passed by a Committee of the House of Commons.

Nottingham.—A Local Government Board inquiry was held here on 25th ult., regarding the Council's application to borrow £40,000 for electric lighting extensions. Mr. Herbert Talbot gave a full explanation of the various items. Alluding to the growth in Nottingham of the demand for electricity as an illuminant, he said that in March, 1895—the undertaking having commenced in September of the previous year—the number of lamps supplied was 8,267; in March of this year, 15,456; and at the present time, 18,570; the number of customers totalling 226. The following is an estimate of the cost:—162,900 cubic feet in buildings, consisting of engine-room, boiler-room, and coal bunkers, and including foundations for engines and dynamos and boiler seatings and flues, at 8d. per foot, £5,430; five steel boilers, 28 feet long and 7 feet diameter, for a working pressure of 150 lbs. per square inch, £2,125; steam main round engine and boiler rooms with the necessary valves, separators, and drain pipes, £655; exhaust main, floor plates and frames, £280; pump injectors, feed pipes, and connections, £382; blow-off pipes and connections, £65; lagging boilers and pipes, with non-conducting composition, £150; one 80-H.P. steam dynamo, £700; one 135-H.P. dynamo, £1,075; three 360-H.P. dynamos, £6,900; steam and exhaust connections, £195; main switchboard, £600; cables for connecting dynamos to switchboard, £350; meters, £1,650; house connections, £900; motor transformers, £3,200; mains (underground), £14,300; contingencies, £1,043; total, £40,000. The period asked for in which to repay the loan was 25 years.

Newmarket.—At the last District Council meeting an attempt made to get the resolution deciding to apply for electric lighting powers, rescinded, was unsuccessful.

Newport.—A Local Government Board inquiry was held on Tuesday, regarding the application of the County Council to borrow £12,000 for electric lighting extensions. Mr. R. Hammond, consulting engineer, stated that already £6,793 odd, out of the £12,000 asked for, has been expended, that amount representing the excess of actual expenditure over the original estimate.

Oldham.—The Town Clerk has had an interview with Prof. Kennedy on the subject of the central station and main extensions which are proposed. Prof. Kennedy estimates the cost of buildings at £4,000, and plant at £5,000. The Electric Lighting Committee recommends the Council to borrow £10,000 for the purpose.

Sheffield.—Brunswick Wesleyan Chapel is to be renovated and improved, one of the items being the introduction of the electric light.

Shoreditch.—For wiring the electric light and refuse destructor buildings for the Vestry, eight tenders were sent in. The lowest tender is that of Messrs. Laing, Wharton and Down, £428 9s. 6d., and the highest the Brush Electrical Engineering Company, £950. Why the great difference?

Tintwistle.—Estimates have been obtained from two firms regarding the probable cost of a scheme for lighting the parish by electricity. One estimate was about £1,100, the other being £2,000. The annual cost of maintenance of a plant capable of lighting 450 16-C.P. lamps is given as £294 odd.

Torquay.—On July 10th, a Local Government Board inquiry is to be held regarding the application of the Council for power to borrow £23,000 for electric lighting purposes. The opposition party wants the Mayor to call a public meeting with a view to abandoning the scheme.

Walsall.—The 14 1,000-C.P. arc lamps which have been erected in Park Street, Bridge Street, the Bridge, and Digbeth were lighted last Saturday night for the first time.

Wells.—The Ratepayers' Association is of opinion that the time has not yet arrived for the introduction of the electric light, and is calling upon the Mayor to summon a public meeting, or make a canvass of the district.

Whitehaven.—There is a little misunderstanding just at present here regarding the electric lighting of the Harbour, which the Commissioners are not altogether satisfied with, whereas the Corporation asserts that the Commissioners receive 40 per cent. more light than they are entitled to. The Commissioners say that the light is sometimes on when it is not necessary, and what they require is efficient service when the light is necessary.

Willesden.—The District Council has decided to refuse its consent to a proposal of the Willesden-Green Electric Light Supply Company to apply for a provisional order for supplying the parish.

Windermere.—There was a discussion on "Gas *v.* Electricity" at the last District Council meeting, and ultimately it was resolved to adopt electricity for lighting the Troutbeck Bridge lamps. Mr. Fowkes, manager of the Electric Light Company, has offered to supply 18 lamp pillars and fittings at a total cost of 38s. per lamp, exclusive of fitting up, and would supply current for them at the same rate as he supplied Bowness, *i.e.*, 25s. per 1,000 hours 16 C.P.

ELECTRIC TRACTION AND MOTIVE POWER NOTES.

A Point for Traction Engineers.—The *Street Railway Review* thinks the time has come when street railway companies should take some concerted action towards ascertaining the best form of wheel tread and rail head for electric railways. This question, though it may seem at first a trivial subject, affects directly two very large items in the expense of operating a street railway, *i.e.*, track depreciation and wheel wear.

Birmingham.—The Public Works Committee, after considering the question very exhaustively, have resolved to recommend the Corporation to consent to an assignment by the Birmingham Central Tramways Company to Messrs. Mackenzie & Ross, and a company to be formed by them, of the existing leases, to the surrender of such leases, and the granting of a new lease or leases for a term of 21 years. The total length so to be acquired is 27 miles 34·7 chains, and includes the electric trams between Navigation Street and Bournbrook.

Brussels.—The Société des Tramways Bruxellois is about to carry out some trials with a conduit system of electric traction on the tramway between the Bois de la Cambre and Schaerbeck. All the electric tramways at present in operation in the Belgian capital are on the overhead conductor system.

Electric v. Cable.—A Chicago exchange says that two more cable lines at Pittsburg are to be abandoned and exchanged to electricity. They are known as the Fifth Avenue and Citizens' lines, and the change is occasioned partly by the consolidation, and partly on account of the advantage of having but one system of operation, and that the electric. Our contemporary adds that there was a growing feeling in favour of the cable system in 1884 and 1885, in some parts, and there are cables running there to-day at a cost for operating expenses which electricity has never been able to displace. In 1885, the electric trolley system came along, and railway managers deferred decision on the cable system for a couple of years. "Had the development of the electric street car motor been delayed even two years," adds our contemporary, "there would unquestionably have been hundreds of miles of cable construction decided on." The reason why the Chicago cable lines are not converted into electric trolley is said to be their cheapness of operation.

Glasgow.—Messrs. Manson & Roberts, of Chicago, having heard that the question of electric traction is under consideration at Glasgow, have written to the *Glasgow Mail* under date June 15th as follows:—"We wish to advise you that the prospect of obtaining a system of electric traction which will be acceptable alike to your people and City Council is now at hand, and will be demonstrated here within a month, when we will be glad to furnish you all details. In this system all wires and connections are underground, thoroughly insulated, thus eliminating the action of electrolysis, also doing away with the unsightly poles and deadly overhead wires, which are being condemned and legislated against throughout the United States. The cost of construction will be slightly in excess of the overhead trolley. There is no waste of energy as with the deadly overhead system, and there is a positive saving of from 10 to 20 per cent. in operation over any other known system."

Leeds.—The members of the Highways Committee of the Leeds Corporation held a meeting on 25th ult. for the purpose of making a selection from the tenders sent in for the work to be done in connection with the electric tramway from Roundhay to Kirkstall Abbey. Before proceeding to consider the tenders, it was necessary to decide what action to take with regard to the offer from the Yorkshire House-to-House Electricity Company to supply the Corporation with electric power for the tramways for three years at a fixed price per unit. Mr. Smithson, in the course of a long speech, strongly advocated the acceptance of the company's offer. He quoted a number of figures with a view to convincing the committee that the Corporation could not possibly supply the electrical energy as cheaply as they could buy it from the company, and pointed out that it would be an advantage to the municipality to have three more years in which to "look round" before embarking on such an extensive operation as the supplying of electricity for the proposed tramway would be.—Alderman Lupton also spoke to the same effect.—Mr. Henry, Alderman Firth, and others stoutly opposed the proposal, however. They refused to believe that the Corporation could buy the power any cheaper than they could make it, and were able to quote the opinion of Dr. Hopkinson in support of their view of the matter. Moreover, they succeeded in showing that the statistics furnished by Mr. Smithson were not as favourable to his case as he had endeavoured to make out, because although the capital outlay on the generating station will be large, the premises will be so constructed that they will readily adapt themselves to the necessities of a much more extensive tramway system than the one with which it is intended to make a commencement. Another point brought forward was the fact that if the Corporation were to buy electrical power from the House-to-House Company, they would be enhancing the capital value of an undertaking which they may, some of these days, have to purchase. The result of the debate was that Mr. Smithson was the only member who voted for his proposition. Ald. Lupton is a shareholder in the House-to-House Company, and therefore did not vote. The tenders were then dealt with. They numbered 82 in all, and came from all parts of the country. A sub-committee had previously carefully gone through the documents, and arranged them systematically, so that all was plain sailing. It was eventually decided to recommend the Council to accept the following tenders:—

	£
No. 1.—Poles and brackets. Messrs. Jas. Russell & Sons, Leeds	3,607
No. 2.—Underground conduits and conductors. Messrs. Greenwood and Batley, Leeds	4,553
No. 3.—Trolley wires and attachments. Messrs. Crompton & Co., Chelmsford	3,370
No. 4.—Electric motor cars. Messrs. Greenwood and Batley	14,000
No. 5.—Accumulators and switches. Chloride Electrical Storage Syndicate	1,341
No. 6.—Steam engines and dynamos. Messrs. Greenwood and Batley	3,707
No. 7.—Boilers. Messrs. Clayton & Co., Hunslet	1,371
No. 8.—Generating station buildings. Mr. J. T. Wright, Leeds	5,815
Total	£37,764

To these amounts will have to be added about £3,000 for sundries which cannot be let in a single contract, so that the total cost of equipping the tramway from the Canal Gardens to Kirkstall Abbey, a distance of over six miles, will be about £41,000. The *Leeds Mercury* says that, owing to improvements which have been brought about in recent years, the vehicles will weigh some 3 tons less than those now running along Roundhay Road. The poles and brackets have been designed by Dr. Hopkinson.

The recommendations came before the City Council on Wednesday afternoon. The Chairman of the Highways Committee (Councillor T. Hannam), in moving the resolution accepting the tenders, expressed regret that Messrs. Crompton & Co. had that day written withdrawing their tender, as they had made a mistake. The next nearest tender was for £5,620, making a difference of £2,250 to the estimate. That matter would be dealt with at a future meeting of the Committee. Councillor Hannam proposed the acceptance of the tenders, with the exception of the one he had mentioned. An amendment to the effect that supply be taken from the Yorkshire House-to-House Company, was lost, and Councillor Hannam's resolution was carried by 44 votes to 8.

Southampton.—The Town Council has had a long discussion regarding a proposal to purchase the tramways, and a resolution has been passed instructing the Works Committee to negotiate with the Southampton Tramways Company as to the purchase of the tramways in the borough, and report thereon to this Council. The proposer of this resolution (Mr. Lemon) having seen the Hamburg electric tramways at work, said that if they did buy them, they should work them by electricity. These remarks were received with applause, which gives an idea that Mr. Lemon will have a number of supporters.

South Staffordshire Tramways.—It is now finally decided, says the *Walsall Free Press*, that the Walsall Corporation take over that portion of the South Staffordshire Electric Tramway System within the borough.

TELEGRAPH AND TELEPHONE NOTES.

Telegraphic Interruptions and Repairs:—

Cables.	Down.	Repaired.
Brest-St. Pierre (1869, Anglo)	April 6th, 1895 ...	...
Puerto Plata-Martinique ...	Dec. 19th, 1895 ...	...
Monte Alegre-Santarem ...	May 5th, 1896 ...	...
Bissao-Bolama	May 30th, 1896 ...	...
Cadiz-Teneriffe	June 7th, 1896 ...	...
Jamaica-Colon	June 10th, 1896 ...	...
Landlines.		
Trans-Continental line beyond Mazol (Mashonaland) Telegrams for Tohikwawa and Blantyre cannot be accepted.	March 12th, 1896 ...	...
Bolinao-Manila—telegrams are sent by post	March 19th, 1896 ...	...
Communication with Cartagena and Barranquilla, Columbia.	May 22nd, 1896 ...	...
Siberian landlines near Chabarovska	June 8th, 1896 ...	...
Saigon-Bangkok	June 15th, 1896 ...	June 25th, 1896.

Telegraphs in Turkey.—The Turkish Posts and Telegraphs authorities are about to erect a telegraph line connecting Benghazi with Tripolis and the telegraphic system of the country.

Lundy Island Cable.—The telegraph cable steamship *Monarch* has, it is stated, succeeded in repairing the Lundy Island cable, which parted three miles seaward about a fortnight ago.

CONTRACTS OPEN AND CLOSED.

OPEN.

Battersea.—July 14th. The Vestry of St. Mary invites tenders for the supply and erection of boilers, engines, switchboards, accumulators, wiring and fittings, &c., &c., for lighting the Municipal Buildings and Town Hall electrically. Particulars from Robert Hammond, consulting engineer, Ormond House, Great Trinity Lane, E.C.

Bedford.—July 14th. The Urban Sanitary Authority invites tenders for the supply of steam coal to their pumping works, sewage pumping works, and the electricity works, for the year ending July 23rd, 1897. Particulars from Mr. Porter, Clerk, Town Hall.

Ealing, W.—July 16th. Tenders are wanted by the District Council for the supply of coal to the electric lighting station, South Ealing; and coal and coke for another depot. Particulars from Mr. C. Jones, C.E., Surveyor to the Council.

France.—July 11th. Tenders are invited for the supply of 25 kilometres of telegraph cable, containing six pairs of paper-insulated conductors. Direction Générale des Postes et des Telegraphes, Rue de Grenelle, 103, Paris.

Germany.—July 25th. Tenders are being invited for the supply and erection of the plant and fittings required for the electric lighting of the railway station at Bretten. Tenders to the General Direction of the Grosse-Badische Staats-Eisenbahnen, Carlsruhe.

Madras.—Nov. 11th. Lieut. Col. C. C. Rawson (in charge Consulting Architects' Division) invites tenders for the lighting by electricity of Government House, Madras, including the banqueting hall and the A.D.C.'s bungalow: also for the lighting of Government House, Guindy, including the Military Secretary's bungalow. Particulars to be obtained on application to the Consulting Architect to the Government of Madras, Chepauk, Madras.

Mexico.—August 31st. The Secretary of State for Foreign Affairs has received from the British Consul at Mexico, a pamphlet issued by the municipal council of that city, containing particulars as to tenders which are called for, for the public lighting of the city by electricity, and which must be put in by the last day of August, 1896. This pamphlet may be seen on application to the Commercial Department of the Foreign Office, between the hours 11-6.

Mexico.—August 31st. The Municipal Council of Mexico is inviting tenders for the concession for the electric lighting of the public streets during a period of eight years.

Wallasey.—July 16th. The District Council invites tenders for condensing apparatus and steam and exhaust pipes in connection with the electric lighting installation.

Wigan.—July 14th. The Gas and Electric Lighting Committee want tenders for gas coal and cannel. Particulars from Mr. J. Timmins, engineer.

CLOSED.

Belfast.—The tender of Messrs. Gregg, Son and Phœnix, for cover plates, has been accepted by the electric Committee.

Burnley.—The tender of Messrs. Callender's Bitumen, Telegraph, &c., Company, amounting to £600 odd, for armoured concentric underground electric light cables, has been accepted by the Corporation.

Hammersmith.—The Vestry has accepted the tender of Callender's Bitumen Telegraph and Waterproof Company, for supplying and laying cables and pipes, at £10,170 odd. There were eight tenders for the first item. Messrs Callender have given two substantial sureties, as required by the Vestry, that they will maintain certain insulation resistances for a period of five years after completion of the works. For the supply and erection of arc lamps and lamp posts, there were six tenders; and for the supply and erection of transformers and sub-station equipment, there were seven. Both these items went to Messrs. Siemens Bros., Limited, at £2,702 and £935 respectively. For the supply and erection of a 5-ton overhead travelling crane, the tender of Messrs. Marshall, Fleming and Jack has been accepted conditionally.

NOTES.

A Coincidence.—Mr. A. A. C. Swinton communicated to the Royal Society on June 10th a paper describing some experiments on the influence of the magnetic field on the cathode rays. He found that when placed in a certain position, a bar electro-magnet had the power of bringing to a focus the cathode rays emanating from a flat aluminium disc, and when placed in another position, the electro-magnet caused the rays to diverge. These experiments appear, as we make them out to be, identical with some of the experiments of Herr Birkeland, of Christiana, first described in the *Elektroteknisk Tidsskrift* of April 20th, and later in the ELECTRICAL REVIEW of June 12th. Herr Birkeland has, however, carried his investigations in this field much further than Mr. Swinton, and we commend the paper cited to the latter gentleman's attention. There is room, however, in this promising field for both these investigators, though it is advisable that one should start where the other leaves off, instead of going over the same ground again.

Cathode Rays.—The writer of the *Daily Chronicle* "Science Notes" appears to have decided in his own mind that all cathode rays are X rays, for in a paragraph regarding Herr Birkelands experiments on "cathode rays under the influence of strong magnetic forces," which were recently dealt with at considerable length in our columns, he says that the experiments were "on the influence of a powerful magnetic field on the X rays."

Congratulations.—The Albert Medal of the Society of Arts has been awarded to Prof. D. E. Hughes, in recognition of the services he has rendered to arts, manufacture, and commerce, by his numerous investigations in electricity and magnetism, especially the printing telegraph and microphone. Prof. Hughes has our congratulations.

Electric Lighting in Spain.—Some time ago we made some comments in a leaderette regretting that English electrical manufacturers were not pushing business in Spain so energetically as they ought. Our remarks were replied to from Spain by those who tried to persuade us that English firms would do better to leave the matter alone. In view of these statements, it is interesting to note some opportune criticism and advice given in British Consul Smith's recent report to Lord Salisbury on the trade and commerce of Bilbao for the year 1895. We would like to rub these words well into English manufacturers, particularly the remarks regarding representation by a traveller on the spot. Consul Smith says:—"Electricity is daily more used in this district. The light is used in streets, in villages, on the river and in many houses; an electric tramway has been laid down from Bilbao to Santurce, and another one is under construction down the right bank of the river. *But I do not notice the names of British firms on any of the apparatus.* None of it is made in Spain, all has to be imported, so that there is a fair field for competition. The only thing is, that Germans have got the start. I should think it well worth the while of British firms to try whether they cannot secure part of the business. Even if they cannot compete in price, it is to be hoped that they can excel in quality; and I may observe that, as regards price, the Germans are handicapped by the payment of a heavier duty. If these remarks meet the eye of electrical plant manufacturers they will, that is, the more enterprising ones, unless they are different from other manufacturers, write to ask me for lists of firms to which they may send their price lists, which are made out in English, and I shall reply that a list of firms will be found in the *Libro de Bilbao*, published by Larranga y Lejarcegui, Calle de Ledesma, No. 22, Bilbao, who will send it post free for 3s.; but that it is far the best plan to send a traveller. The fact is, that the traveller is almost necessary when it is desired to supersede an article already in possession, but unfornately the use of travellers never seems to commend itself to British firms."

International Electrical Congress at Geneva.—The Swiss Society of Electrical Engineers is organising an International Electrical Congress to be held from August 4th to 9th, at Geneva. There is at present being held there the National Swiss Exhibition, and the President of the Committee of that exhibition (M. Turrettini) will be president of the Conference. The New York, London, Brussels, Paris, Berlin, and Vienna Societies of Electrical Engineers have given their patronage to the Conference, at which papers on various subjects will be read and discussed, and excursions be made to the principal electrical installations in Switzerland. The following subjects are set down for discussion at the Congress: (*a*) Magnetic units; (*b*) Photometric units; (*c*) Transmission and distribution of power for great distances by means of: 1° Direct currents; 2° Alternate currents; (*d*) Protection of high pressure overhead electric lines against atmospheric discharges; (*e*) Various disturbances caused by electric traction. Anyone wishing to be present, or requiring particulars regarding the Conference, should inquire at the office of the International Electrical Congress, Universaité, Geneva.

The Institution Conversazione.—Among the large number of members and visitors present at the conversazione on 25th ult. were:—Sir Frederick Abel, Bart.; Prof. W. Grylls Adams; Prof. Armstrong; Prof. W. E. Ayrton; Sir Benjamin Baker, K.C.M.G.; Mr. H. W. Christmas (Consul-General for Servia); Prof. Cleve; Captain E. W. Creak, R.N., F.R.S.; Prof. W. Crookes, F.R.S.; Prof. G. Carey Foster, F.R.S.; Mr. Charles Hawksley; Prof. D. E. Hughes, F.R.S., Lord Kelvin, D.C.L., F.R.S.; Prof. A. B. W. Kennedy, F.R.S.; Sir Henry Mance, C.I.E.; Prof. John Perry, F.R.S.; Mr. W. H. Preece C.B., F.R.S.; Prof. W. C. Roberts Austen, C.B., F.R.S.; Major Ruck, R.E.; Mr. Alexander Siemens; Mr. C. E. Spagnoletti; Mr. J. W. Swan, F.R.S.; Prof. S. P. Thompson, F.R.S.; Sir E. Leader Williams; Major-General Webber, C.B.; and Mr. T. C. Martin (from U.S.A.). A pleasing selection of music was performed during the evening by the Æolian Ladies' Orchestra, conducted by Miss Rosabel Watson.

Silver Medal.—For his paper on "Röntgen Photography of the Invisible," the Council of the Society of Arts has awarded a silver medal to Mr. A. A. Campbell Swinton.

Northampton Institute, Clerkenwell.—We are pleased to note that this new addition to the educational and social Institutes of the Metropolis was partially opened in quite an informal manner for the use of members on Saturday, the 27th ult., at 3 p.m. The educational side of the Institute is not yet ready for occupation, but it is hoped that it will be available at the commencement of the educational year in October. The part opened on Saturday consists of the various social rooms, library and reading room, refreshment rooms, gymnasium, and the large hall. We may add that the buildings are situated in St. John Street Road, Clerkenwell, and that they cover 1¼ acres of ground, generously given by the Marquis of Northampton, and the total capital expenditure on buildings and equipment will probably not fall short of £70,000. At Saturday's opening there were present: Mr. Chas. Dorman, Chairman of the Governing Body, Lieut.-Gen. Laurie, M.P., Mr. L. B. Sebastian, Mr. Herbert Wix, Rev. J. H. Rose, M.A., Dr. Garnett and Miss Pycroft, of the Technical Education Board, Principal Dr. R. Mullineux Walmsley, the Clerk to the Governing Body, Mr. Sidney Axford, the Lady Superintendent, Miss Wheeler, and others.

Summer Meeting.—The summer meeting of the Institution of Mechanical Engineers will be held in Belfast, commencing on Tuesday, July 28th. The following papers of interest to the electrical profession will be read:—"Electric Lighting in Belfast," by Mr. V. A. H. McCowen, electrical engineer to the Belfast Corporation; "Rope Driving," by Mr. Abram Combe; "Description of the Alumina Factory at Larne Harbour," by Mr. James Sutherland. There will be a large number of excursions to various places, and visits to works in the Belfast district.

An Alleged Slander.—Yesterday Mr. Medhurst, electrical engineer, was plaintiff in an action for slander brought against Mr. Kyffin, a member of the Hackney Vestry. The case for the plaintiff was, that the defendant said to a member of the Electricity Committee and to two other vestrymen, that the plaintiff had bribed the chairman of the Committee with a £50 note in order to obtain the appointment of electrical engineer to the Committee. At the time of going to press the case was proceeding.

A Shiel's amang ye takin' Notes.—Even justice itself makes mistakes sometimes. We learn that Mr. Sheil, the magistrate, who has often complained of the Corporation dust destructor at Lett's Wharf, near Waterloo Bridge, wrote under date of June 16th:—"It (the dust destroyer) was most offensive last night, and has been again so to-day." At Tuesday's meeting of the Commissioners of Sewers, the superintendent of cleansing informed the Court that *the destructor was out of repair, and had not been used since May* 23rd.

Libel Action Discontinued.—A libel action was recently commenced by a County Antrim farmer named Taggart against Dr. Traill, of the Giant's Causeway and Portrush Electric Railway Company, for statements which he was alleged to have uttered in his capacity as chairman of that company. The action has been discontinued.

Electrical Engineer Wanted for Madrid.—In our Advertisement columns will be obtained particulars of a vacancy which occurs in Madrid for a chief electrical engineer for the English electricity works there. The salary is £500 per annum and bonus. Applications have to be sent in by July 11th.

Personal.—We are informed that the Board of Trade has appointed Mr. Hugh Erat Harrison, Principal of the Electrical Standardising Testing and Training Institution, electric inspector to the Corporation of Newport (Mon.).

Marriage.—We have pleasure in congratulating Mr. Frederick Bedell upon his marriage to Miss Mary Louise Crehore, which took place in London on Wednesday, July 1st.

Horseless Carriage Bill.—This Bill was read a second time in the House of Commons on Tuesday, and after lengthy discussion, was referred to the Standing Committee on Law.

NEW COMPANIES REGISTERED.

Preston Electric Company, Limited (48,495).—This company was registered on June 25th with a capital of £3,000 in £1 shares, to acquire the business carried on by G. W. Preston, to adopt a certain agreement, and to carry on the business of electric lighting, electrical and mechanical engineers, telegraph and telephone engineers, tool makers, brass founders, metal workers, &c. The subscribers (with one share each) are:—C. H. Priddy, 60, Anglesey Street, Lozells, Birmingham, clerk; J. Knight, 1, Brighton Place, Balsall Heath, Birmingham, clerk; H. G. Mills, 186, Westminster Road, Handsworth, Birmingham, clerk; J. McGann, 68, Eversley Road, Small Heath, Birmingham, clerk; J. S. Harper, 340, Moseley Road, Birmingham, clerk; A. M. Walker, Woodstock Road, Moseley, Birmingham, clerk; J. C. Atkins, 103, Dearman Road, Birmingham, vestry clerk. Registered, without articles of association, by D. Davis, 11, Lincoln's Inn Fields, W.C.

Standard Dynamo and Motor Manufacturing Company, Limited (48,471).—This company was registered on June 24th with a capital of £2,000, in 340 ordinary and 60 deferred shares of £5 each, to acquire and carry on the business of electrical engineers and dynamo builders now carried on by R. Andrews and T. Preece at the Perseverance Works, Harris Street, Bradford, as "Thomas Preece and Co.," and to enter into an agreement with the said R. Andrews and T. Preece. The subscribers are: J. Varey, Perseverance Works, Bradford, engineer, 12 shares; J. Tate, Perseverance Works, Bradford, engineer, 20 shares; T. R. Andrews, 3, Edmund Street, Bradford, electrical engineer, 10 shares; T. Preece, 14, Airview Terrace, Keighley, electrical engineer, one share; L. Whitaker, 11, Arm Place, Bradford, engineer, 15 shares; W. Beanland, 35, Hustlergate, Bradford, chartered accountant, one share; G. F. H. Gardner, 35, Hustlergate, Bradford, accountant, one share. The number of directors is not to be less than three, nor more than five; qualification, £50; remuneration as the company may decide. Registered office, 192, Harris Street, Bradford.

British Incandescent Electric Lamp Company, Limited (48,521).—This company was registered on June 26th, with a capital of £10,000, in £1 shares, to carry on the business of electrical engineers and manufacturers of, and dealers in incandescent electric lamps and other electrical apparatus and appliances. The subscribers (with one share each) are:—M. A. King, 36, Spey Street, Poplar, E. clerk; T. Lindsay, 66, Waterloo Bridge Road, S.E., traveller; H. Furber, 26, Witherington Road, Drayton Park, N., clerk; E. Nicholls, 64, Chetwynd Road, Highgate, typist; G. W. Smith, 15, Wellington Square, Chelsea, clerk; A. P. Dunn, 17, Oxford Road, Stroud Green, typist; I. Andrews, 21, Hamlet Road, Southend, clerk. The number of directors is not to exceed seven; the subscribers are to appoint the first; qualification, one share; remuneration one guinea each per board meeting attended. Registered by J. H. Farmer, 28, Austin Friars, E.C.

CITY NOTES.

The Southampton Electric Light and Power Company.

We have, from time to time, notified in our "Notes" columns the transference of this undertaking to the Corporation, and probably the accounts that are before us will probably be the last record for a complete year's working that will be issued by the company. The provisional contract for the sale to the Corporation for the sum of £21,000 has been signed, and no doubt the actual transfer will soon be effected. There are certain items in the working expenses that are rather high. For instance, coal cost is not a record, but there is little doubt that the contract for working the electric cranes of the Southampton Harbour Board, is to a great extent responsible for this. The company have to run a 55-kw. plant for an average consumption of 10 units per hour for an average of 20 hours a week, of which 10 are at night, when but for this the station would be shut down. As the maximum demand of these cranes is so great, it cannot be met from the lighting mains. There is an increase in the rent, due to the fact that land which will shortly be required for extensions had to be taken as it became vacant. The increase in management expenses is caused by the full amount of £200 being debited instead of £100 as in 1894.

The following table gives the cost per unit:—

	1893.	1894.	1895.
Total capital invested	—	—	£19,187
Number of units sold	—	—	100,473
Number of lamps connected ...	—	—	5,387
Revenue from sale of current ...	—	—	£2,784
Net revenue	—	—	£967
Average price obtained per unit..	—	—	6·6d.

Cost of Production.	£	s.	d.	Per unit.
Coal	547	0	0	1·30d.
Oil, waste, water, and engine room stores	83	0	0	·20d.
Salaries and wages at generating station	539	0	0	1·28d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	188	0	0	(Works' cost 3·23d.) ·45d.
Rates and taxes	97	0	0	·23d.
Management expenses, directors' remuneration, salaries of managing engineer, secretary, clerks, &c., stationery and printing, general establishment charges, auditors, law charges and insurance	442	0	0	1·05d.
Depreciation of buildings and plant account	—			—
Renewal fund account	—			—
Total	£1,896	0	0	4·51d.

Revenue.	£	s.	d.	Average price obtained per unit.
By sale of current	2,784	0	0	6·6d.
Meter rents	14	0	0	—
Sale of Lamps				—
Total	£2,798	0	0	6·6d.

Total cost per unit (exclusive of depreciation and renewal accounts), 4·51d.; works' cost, 3·23d.

Analysis of the Bournemouth Cost of Production.

ALTHOUGH the Bournemouth Company has not yet reached the dividend-paying stage, the condition of the company is by no means unsatisfactory. There has been a considerable expenditure during the year, the capital account now standing at £74,858. Although a reduction in the price of current was made in the early part of 1895, the total income has been increased by £459 13s. 9d. Connections to the company's mains continue to be made at a satisfactory rate.

The following table gives the cost per unit:—

	1893.	1894.	1895.
Total capital invested	—	—	£74,858
Number of units sold	—	—	243,816
Number of lamps connected	—	—	20,978
Revenue from sale of current	—	—	£6,796
Net revenue	—	—	£2,159
Average price obtained per unit	—	—	6·69d.

Cost of Production.	£	s.	d.	Per unit.
Coal	1,880	0	0	1·85d.
Oil, waste, water, and engine room stores	475	0	0	·47d.
Salaries and wages at generating station	1,236	0	0	1·22d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	441	0	0	(Works' cost 3·97d.) ·43d.
Rates and taxes	249	0	0	·25d.
Management expenses, directors' remuneration, salaries of managing engineer, secretary, clerks, &c., stationery and printing, general establishment charges, auditors, law charges and insurance	826	0	0	·81d.
Depreciation of buildings and plant account	—			—
Renewal fund account	—			—
Total	£5,107	0	0	5·03d.

Revenue.	£	s.	d.	Average price obtained per unit.
By sale of current	6,796	0	0	6·69d.
Meter rents	384	0	0	—
Sale of lamps	—			—
Total	£7,180	0	0	6·69d.

Total cost per unit (exclusive of depreciation and renewal accounts), 5·03d.; works' cost, 3·97d.

The Exeter Electric Light Company, Limited.

IN a very short time the undertaking of the Exeter Electric Company will be transferred to the local authority, and in all probability these are the last accounts that will be issued prior to the property being handed over. The gross profit on the year's work is £801, but this is reduced to £713 by winding-up and other expenses incidental to the transfer, and this balance will be added to the purchase money received by the proprietors, instead of being devoted to payment of interest or depreciation fund.

For a station of small output, the figures are fairly good, especially when one considers that the expansion of the business has been seriously hampered by the financial weakness of the company. But what has a still more important bearing on the cost of production is the fact that an amount of current, equal to more than 50 per cent. of the total units sold, is lost in distribution, the principal source of loss being the small inefficient transformers, which the company has not been in a position to replace by better ones. No doubt the ownership of the corporation will enable Mr. Munro to speedily show a marked economy in working.

The following table gives the cost per unit:—

	1893.	1894.	1895.
Total capital invested	—	—	£22,283
Number of units sold	—	—	110,000
Number of lamps connected	—	—	7,500 and 20 arcs.
Revenue from sale of current	—	—	—
Net revenue	—	—	£2,525
Average price obtained per unit	—	—	5·51d.

Cost of production.	£	s.	d.	Per unit.
Coal	542	0	0	1·18d.
Oil, waste, water and engine room stores	260	0	0	·57d.
Salaries and wages at generating station	663	0	0	1·44d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	270	0	0	(Works' cost 3·78d.) ·59d.
Rates and taxes	56	0	0	·12d.
Management expenses, directors' remuneration, salaries of managing engineer, secretary, clerks, &c., stationery and printing, general establishment charges, auditors, law charges, and insurance	252	0	0	·55d.
Depreciation of buildings and plant account	—			—
Renewal fund account	—			—
Total	£2,043	0	0	4·45d.

Revenue.	£	s.	d.	Average price obtained per unit.
By sale of current	2,525	0	0	5·51d.
Meter rents	75	0	0	—
Sale of lamps	—			—
Total	£2,600	0	0	5·51d.

Total cost per unit (exclusive of depreciation and renewal accounts), 4·45d.; works' cost, 3·78d.

The Nottingham Accounts.

THE accounts of the undertaking for the year 1895 show that steady progress is being made with electric lighting in Nottingham. Although there is nominally a deficit on the year's working of £2,284, it has to be remembered that this sum is made up of items such as preliminary expenses, interest, salaries, &c., which were incurred previous to the opening of the station. Taking the year's working apart from expenses incurred in previous years, there is an actual profit of over £500, after providing £1,405 for interest on capital and £356 for sinking fund. The receipts for the period under review amount to £4,353, while the working expenses do not exceed £2,044. Altogether, the Nottingham Corporation have every reason to be gratified with the progress that the electricity works are making, and Mr. Talbot is to be congratulated upon bringing them to such an efficient state. We ought to mention that under the head of repairs and maintenance, accumulators are debited with £164 6s. This is accounted for by the fact that the Corporation have a seven years' maintenance contract with the contractors, so that they are practically paying for renewals in advance.

The following table gives the cost per unit:—

	1893.	1894.	1895.
Total capital invested	—	—	£53,720
Number of units sold	—	—	171,654
Number of lamps connected	—	—	15,419
Revenue from sale of current	—	—	£4,123
Net revenue	—	—	£2,809
Average price obtained per unit	—	—	5·7d.

Cost of production.	£	s.	d.	Per unit.
Coal	429	0	0	·60d.
Oil, waste, water, and engine room stores	106	0	0	·15d.
Salaries and wages at generating station	376	0	0	·53d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	264	0	0	(Works' cost 1·65d.) ·37d.
Rates and taxes	48	0	0	·07d.
Management expenses, directors' remuneration, salaries of managing engineer, secretary, clerks, &c., stationery and printing, general establishment charges, auditors, law charges, and insurance	771	0	0	1·08d
Depreciation of buildings and plant account	—			—
Renewal fund account	—			—
Total	1,994	0	0	2·80d.

Revenue.	£	s.	d.	Average price obtained per unit.
By sale of current	4,123	0	0	5·7d.
Meter rents	141	0	0	—
Sale of lamps	—			—
Total	£4,264	0	0	5·7d.

Total cost per unit (exclusive of depreciation and renewal accounts), 2·80d.; works' cost, 1·65d.

Messrs. Parker, Limited.

This company has certainly commenced its career in most promising fashion, for there are few manufacturing companies that are able to signalise their first complete year's working with a 5 per cent. dividend. It will be seen from the subjoined directors' report, and the remarks made at the meeting, that the prospects are exceedingly good. With the shops fully occupied and the able management, this company should eventually occupy a strong position among industrial concerns.

The directors' report of this company is as follows:—

The directors have pleasure in submitting the annexed balance-sheet, which they consider thoroughly satisfactory. The balance standing to the credit of profit and loss account is £2,805 11s. 10d. Out of this the directors propose to pay a dividend at the rate of 5 per cent. per annum, amounting to £2,387 19s., and to carry forward to next year the balance of £417 12s. 10d. The directors have not thought it necessary to write anything off the capital assets of the company, as the buildings, plant, machinery, and tools are all new; but have written off one-third of preliminary expenses, and half of the amount at which the patterns account stood at April 30th, 1895. The director who retires by rotation is Mr. R. Armistead, who is eligible for, and offers himself for re-election. The auditors, Messrs. Allen Edwards and Smith, also retire, but are eligible for, and offer themselves for re-election.

The second annual general meeting of this company was held at the works, Wednesfield Road, Wolverhampton, last Friday afternoon. Mr. C. T. Mander presided.

The Chairman, in moving the adoption of the report and statement of accounts, congratulated the company that as the result of a little more than a year's actual working, they were able to pay a 5 per cent. dividend. That augured well, and in his opinion, they might look forward to a time in the near future when they could pay 50 or 100 per cent. more dividend, that was to say, from 7½ to 10 per cent. They had an able managing director and an efficient staff. In the balance-sheet the directors' fees were put down at £1,222 12s. It seemed a large sum, and it should not be stated exactly in that form, because those were the fees ever since the company started, and represented over two years, the fees for the past 12 months being only £500. The buildings and plant were practically new, and therefore it was not considered necessary to write off a sum for depreciation. They had spent about £12,000 during the past year in additional plant, buildings and machinery. The item of £7,913 3s. 10d. put down on the asset side as "being stock on hand as certified by the managing director," included a large quantity of finished stock which was ready to go out, but which had not been invoiced. It was waiting to leave to complete other orders. A good deal of that money represented finished goods taken down in stock at cost price. He was personally pleased at the success of the company so far, and had every belief in its future prosperity. They would very probably make larger profits. There were still 1,148 shares unissued, and he thought so well of the company that he was of opinion that these shares should be issued at a premium, but his co-directors overruled him, thinking that the shareholders who had borne the brunt of the battle in establishing the business—when they did not know there was a 5 per cent. dividend to draw—should have the opportunity of subscribing for these shares at par. That day the directors had passed a resolution to the effect that the shares referred to should be issued at par to the shareholders if they applied for them between now and July 20th, and paid for £3 on application, £3 on October 1st, and £2 on December 1st, making them paid up in the same proportion as their present shares were paid. If the shareholders did not take the shares up in this way, he should strongly recommend the directors to issue them to outsiders at, say, £1 premium. In the near future they would probably want to extend their sphere of action and increase their capital. It was now £75,000, and they might like to raise it to £100,000 at least, and he had no doubt that they might issue the £25,000 at £1 premium per share, if not £2.

Mr. Parker seconded, and alluding to the writing-off on the capital, said it was impossible to make it clear to the shareholders the amount of money and the value that had had to be put into the concern to keep it moving, and to educate the men in the work.

The motion was adopted.

The Accounts for the Borough of Stafford.

The Stafford Corporation works were only opened on October 15th last, consequently the electric lighting accounts, made up to the end of the municipal year, March 31st, cannot be held to show much, especially as the working expenses naturally include those incidental to the starting of new works. Practically, there is a deficit on the whole year of about £1,000, but this includes 12 months' interest on the borrowed money, and a 12 months' repayment of loan. The sum of £15,969 has been spent on works.

The following table gives the cost per unit:—

	1893.	1894.	1895.
Total capital invested	—	—	£15,969
Number of units sold	—	—	17,457
Number of lamps connected ...	—	—	—
Revenue from sale of current...	—	—	£442
Net revenue	—	—	—
Average price obtained per unit	—	—	6·12d.

Cost of Production.	£	s.	d.	Per unit.
Coal	50	0	0	·68d.
Oil, waste, water, and engine room stores	15	0	0	·21d.
Salaries and wages at generating station	74	0	0	1·01d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	62	0	0	(Works' cost 2 75d.) ·85d.
Rates and taxes	10	0	0	·14d.
Management expenses, directors' remuneration, salaries of managing engineer, secretary, clerks, &c., stationery and printing, general establishment charges, auditors, law charges, and insurance	119	0	0	1·63d.
Depreciation of buildings and plant account	—			—
Renewal fund account	—			—
Total	£330	0	0	4·52d.

Revenue.	£	s.	d.	Average price obtained per unit.
By sale of current	442	0	0	6·1d.
Meter rents, &c.	16	0	0	—
Sale of lamps	—			—
Total	£458	0	0	6·1d.

Total cost per unit (exclusive of depreciation and renewal accounts), 4·52d.; works' cost, 2·75d.

Lazare, Weiller & Co.—In our recent abstract of the report of this company, an error occurred on the second and fourth lines of the second paragraph, where 37·50 per cent. and 40 per cent. should evidently read 37·50 francs per share and 40 francs per share (of 500 francs).

Consolidated Telephone Construction and Manufacturing Company.—The directors have resolved to recommend to the shareholders at the approaching annual general meeting that, subject to audit, a dividend at the rate of £1 10s. per cent. per annum, less income-tax, be paid for the year ending 31st March, 1896.

The City of London Electric Lighting Company, Limited.—The warrants for interest, due the 30th inst., on this company's debenture stock have been posted.

TRAFFIC RECEIPTS.

The City and South London Railway Company. The receipts for the week ending June 28th, 1896, were £891; week ending June 30th, 1895, £780; increase, £111; total receipts for half-year, 1896, £24,069; corresponding period, 1895 £23,873; increase, £196.

The Liverpool Overhead Railway Company. The receipts for the week ending June 28th, 1896, amounted to £1,219; corresponding week last year, £1,193; increase, £26.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending June 26th, 1896, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,856.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1893.	1894.	1895.	Closing Quotation, June 24th.	Closing Quotation July 1st.	Business done during week ended July 1st, 1896. Highest.	Lowest
173,400£	African Direct Teleg., Ltd., 4 % Deb.	100	4 %	4 %	4 %	101 —105	100 —104	...	...
25,000	Amazon Telegraph, Limited, shares...	10	...	...	...	10 — 11	9 — 10	9⅝	...
1,012,880£	Anglo-American Teleg., Ltd.	Stock	£2 11s.	£2 2s.	£2 9s.	47 — 49	48 — 50	49½	...
2,993,560£	Do. do. 6 % Pref.	Stock	£5 2s.	£4 4s.	£4 18s.	92 — 93	92½— 93½	93	92½
2,993,560£	Do. do. Defd.	Stock	...	...	...	9 — 9¼	9 — 9¼	9¼	9⅜
130,000	Brazilian Submarine Teleg., Ltd.	10	6¼% §	7 %	...	15 — 15½	15 — 15½	15 7/16	15
75,000£	Do. do. 5 %, Debs., 2nd series, 1906	100	5 %	5 %	5 %	113 —117	111 —115 xd	...	...
44,000	Chili Telep., Ltd., Nos. 1 to 44,000	5	... §	2½%	...	3¼— 3⅜	3¼— 3⅜	...	...
10,000,000$	Commercial Cable Co.	$100	7 %	7 %	7 %	160 —170	160 —170	...	...
224,850	Consolidated Telep. Const. and Main., Ltd.	10/-	2 % §	1½%	1½%	1/16— 1/8	1/16— 1/8	...	...
16,000	Cuba Teleg., Ltd.	10	8 %	8 %	8 %	12½— 13½	12½— 13½	...	...
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	19½— 20½	19½— 20½	20¼	...
12,931	Direct Spanish Teleg., Ltd.	5	4 %	4 %	4 %	3¾— 4¼	3¾— 4¼	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 — 10½	10 — 10½	...	...
30,000£	Do. do. 4½ % Debs. Nos. 1 to 6,000 ...	50	...	4½%	4½%	108 —111 %	106 —109%xd	...	...
60,710	Direct United States Cable, Ltd.	20	2½% §	2 %	...	9¾— 10¼	9¾— 10¼	10 1/16	9⅞
400,000	Eastern Teleg., Ltd., Nos. 1 to 400,000	10	6½% §	6½%	...	17 — 17⅜	17 — 17⅜	17⅝	17⅜
70,000	Do. 6 % Cum. Pref.	10	6 % §	6 %	...	18¼— 18⅝	18¼— 18⅝	...	...
102,100£	Do. 5 % Debs., repay. August, 1899	100	5 %	5 %	...	106 —109	106 —109	...	...
1,297,837£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	...	131 —134	131 —134	...	...
250,000	Eastern Extension, Australasia and China Teleg., Ltd. ...	10	7 %	7 %	7 %	17½— 18	17½— 18	18	17⅝
54,100£	Do. 5 % (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,049, 3,976 to 4,326	100	5 %	5 %	5 %	101 —105	100 —104 xd	...	...
194,300£	Do. do. Bearer, 1,050—3,975 and 4,327—6,400	100	5 %	5 %	5 %	102 —105	101 —104 xd	...	...
320,000£	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	132 —135	132 —135	...	...
80,600£	Eastern and South African Teleg., Ltd., 5 % Mort. Deb. 1900 redeem. ann. drgs., Reg. Nos. 1 to 2,343	100	5 %	5 %	5 %	101 —105	100 —104 xd	...	...
107,600£	Do. do. do. to bearer, 2,344 to 5,500	100	5 %	5 %	5 %	102 —105	101 —104 xd	102½	...
300,000£	Do. 4 % Mort. Debs. Nos. 1 to 3,000, red. 1909	100	4 %	4 %	4 %	105 —108	106 —109	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	110 —113 %	111 —114 %	113½	...
180,227	Globe Telegraph and Trust, Ltd.	10	4⅜% §	4½%	...	10½— 11	10½— 11	10 13/16	10⅝
180,042	Do. do. 6 % Pref.	10	6 % §	6 %	...	17 — 17½	17 — 17½	...	...
150,000	Great Northern Teleg. Company of Copenhagen	10	8⅜%	8⅜%	10 %	23½— 24½	23½— 24½	...	...
160,000£	Do. do. do. 5 % Debs.	100	5 %	5 %	5 %	104 —107	104 —107	...	...
17,000	Indo-European Teleg., Ltd.	25	10 %	10 %	10 %	52 — 55	52 — 55	54	52½
100,000£	London Platino-Brazilian Teleg., Ltd. 6 % Debs.	100	6 %	6 %	6 %	110 —113	110 —113	...	...
28,000	Montevideo Telephone 6% Pref., Nos. 1 to 28,000... ...	5	4 %	4 %	...	2 — 2½	2 — 2½	...	...
484,597	National Teleph., Ltd., 1 to 484,597	5	5 % §	5 %	5¼%	7⅛— 7⅜	7⅛— 7⅜	7⅜	7 1/16
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	17 — 19	17 — 19	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	16½— 17½	16½— 17½	...	...
119,234	Do. 5 % Non-cum. 3rd Pref., 1 to 119,234	5	5 %	5 %	5 %	6¾— 7	6¾— 7	...	...
1,100,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	107 —110	105 —108 xd	107½	...
171,504	Oriental Teleph. & Elec., Ltd., Nos. 1 to 171,504, fully paid	1	...	4½%	5 %	3/16— 7/16	1/16— 3/16	...	...
100,000£	Pacific and European Tel., Ltd., 4 % Guar. Debs, 1 to 1,000	100	4 %	4 %	4 %	108 —111	105 — 109xd	...	...
11,839	Reuter's Ltd.	8	0 %	*nil*	5 %	6½— 7½	6½— 7½	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	135 —140	136 —141	...	...
58,000	United River Plate Teleph., Ltd.	5	...	3 %	...	3½— 4	3½— 4	...	...
146,733£	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	100 —105	99 —104 xd	...	...
15,609	West African Teleg., Ltd., 7,501 to 23,109	10	*nil*	*nil*	4 %	7 — 8	7 — 8	...	...
238,300£	Do. do. do. 5 % Debs.	100	5 %	5 %	5 %	103 —106	103 —106	...	...
30,000	West Coast of America Teleg., Ltd.	10	*nil*	*nil*	*nil*	1 — 2	1 — 2	...	...
150,000£	Do. do. do. 8 % Debs., repay. 1902	100	8 %	8 %	8 %	102 — 107	98 —103 xd	...	...
64,248	Western and Brazilian Teleg., Ltd.	15	2½%	3 %	3 %	9 — 9½	8¾— 9¼	9 1/16	...
33,129	Do. do. do. 5 % Pref. Ord. ...	7½	5 %	5 %	5 %	6⅝— 7⅛	6⅝— 7⅛	...	...
33,129	Do. do. do. Def. Ord.	7½	...	1 %	1 %	2½— 3	2½— 2⅝	...	...
165,200£	Do. do. do. 6% Debs. "A," 1880 Red.	100	6 %	6 %	6 %	105 —109	105 —109	...	...
206,400£	Do. do. do. do "B," do.	100	6 %	6 %	6 %	105 —109	105 —109	...	...
88,321	West India and Panama Teleg., Ltd.	10	⅞%	1⅛%	⅞%	1 — 1⅛	1 — 1⅛	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	11½— 11⅝	11½— 11⅝	11 9/16	11⅝
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	9½— 10½	9½— 10½	...	...
80,000£	Do. do. 5 % Debs. No. 1 to 1,800 ...	100	5 %	5 %	5 %	109 —112	107 —110 xd	...	...
1,777,000$	Western Union of U. S. Teleg., 7 % 1st Mort. Bonds ...	$1000	7 %	7 %	7 %	110 —115	110 —115	...	...
164,300£	Do. do. 6 % Ster. Bonds.	100	6 %	6 %	6 %	102 —105	102 —105	...	...

ELECTRICITY SUPPLY COMPANIES.

30,000	Charing Cross and Strand Electy. Supply	5	4½%	4½%	5 %	8¼— 8⅜	8¼— 8⅜	...	...
10,277	*Chelsea Electricity Supply, Ltd., Ord., Nos. 1 to 10,277 ...	5	5 %	5 %	5 %	7⅞— 8	7⅞— 8	...	...
60,000	Do. do. do. 4½ % Deb. Stock Red. ...	Stock	...	...	4 %	116 —119	114 —116 xd	...	...
40,000	City of London Elec. Lightg. Co., Ltd., Ord. 40,001—80,000	10	...	5 %	5 %	14½— 15½	14½— 15½	15½	...
40,000	Do. do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	16½— 17	16½— 17	17	...
300,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	5 %	5 %	... ...	132 —136 xd	...	...
22,475	County of London and Brush Prov. Elec. Ligtg., Ltd., Ord. 1—22,475	10	...	...	*nil*	8¼— 9½	8½— 9½	...	...
10,000	Do. do. do. 6% Pref., £8 pd., 40,001—50,000	10	...	...	6 %	12½— 13½	13½— 13⅝	13 7/16	13½
50,000	†Liverpool Electric Supply, all paid	5	5 %	5⅛%	6 %	8 — 8¼	8 — 8¼	...	...
49,300	*Metropolitan Electric Supply, Ltd., 101 to 50,000 ...	10	2¼%	3 %	4 %	12 — 14	13½— 14½	13 13/16	13½
150,000£	Do. 4½% first mortgage debenture stock	...	4½%	4½%	4½%	120 —123	119 —121 xd	122½	...
6,452	Notting Hill Electric Lightg. Co., Ltd.	10	...	1 %	2 %	9½— 9⅝	9½— 10	...	...
19,980	St. James's & Pall Mall Elec. Light Co., Ltd., Ord., 101-20,080	5	4½%	6½%	7½%	11½— 11⅝	11½— 11⅝	11⅝	11 11/16
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	9½— 10½	9½— 10½	10⅝	...
67,900	*Westminster Electric Supply Corp., Ord., 101 to 60,000 ...	5	4 %	5 %	7 %	10 — 10½	10⅛— 10⅜	10⅜	10

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid. || Dividends paid in deferred share warrants, profits being used as capital.

Dividends marked ‡ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL, COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1893.	1894.	1895.	Closing Quotation, June 24th.	Closing Quotation, July 1st.	Business done during week ended July 1st, 1896. Highest.	Lowest
90,000	Brush Elecl. Enging. Co., Ord., 1 to 90,000	3	5 % §	2½%	...	1⅛ — 1⅜	1⅛ — 1⅜	1 5/16	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	6 % §	3 %	...	1½ — 1⅝	1½ — 1⅝	...	...
125,000£	Do. do. 4½ % Perp. Deb. Stock.... ...	Stock	4½%	4½%	...	111 —114	112 —115	...	...
630,000£	City and South London Railway	Stock	1 1/16%	1⅛%	1 1/16%	42 — 44	43 — 45	44	43
28,180	Crompton & Co., Ltd., 7 % Cum. Pref. Shares, 1 to 28,180	5	3 % §	*nil*	...	2 — 2½	2 — 2½	...	...
89,261	Edison & Swan United Elec. Lgt., Ltd., "A" shrs, £3 pd. 1 to 89,261	5	7 %	5 %	...	1½ - 2	1½ — 1⅝	1½	...
17,139	Do. do. do. "A" Shares 01—017,139	5	7 %	5 %	...	2½ — 3½	2½ — 3½	3½	...
100,000	Do. do. do. 4½% Deb. Stock Red. ...	Stock	...	4½%	...	105 —108	103 —105xd	105	104
110,000	Electric Construction, Ltd., 1 to 110,000	2	*nil*	*nil*	...	1⅛ — 1⅜	1⅛ — 1½	1 7/16	...
12,845	Do. do. 7 % Cum. Pref., 1 to 12,845 ...	2	7 %	7 %	...	2½ — 3	2½ — 3	...	...
91,195	Elmore's Patent Cop. Deposg., Ltd., 1 to 70,000	2	*nil*	*nil*	...	½ — ⅝	½ - ⅝	...	...
69,385	Elmore's Wire Mfg., Ltd., 1 to 69,385, issued at 1 pm. ...	2	*nil*	*nil*	...	⅝ - ¾	⅝ — ¾	...	...
9,600£	Greenwood & Batley, Ltd., 7 % Cum. Pref., 1 to 9,600 ...	10	*nil*	*nil*	...	10½ — 11½	10½ — 11½	...	...
10,000	Henley's (W. T.) Telegraph Works, Ltd., Ord.	10	5 %	6 %	8 %	17 — 18	17 — 18	18	17½
3,000	Do. do. do. 7% Pref.	10	7 %	7 %	7 %	17 — 18	17 — 18	...	...
50,000	Do. do. do. 4½ Mort. Deb. Stock	Stock	...	...	4½%	109 —114	109 —114	...	...
50,000	India-Rubber, Gutta Percha and Teleg. Works, Ltd ...	10	12½%	10 %	10 %	23 — 24	21 — 23	23¼	21½
300,000	Do. do. do. 4 % 1st Mort. Debs.	100	...	...	...	105 —108	105 —108	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	1 %	1½%	2 7/8%	13 15/16 — 14 1/16	13 15/16 — 14 1/16	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	17⅞ - 17⅞	17⅞ — 17⅞	...	...
37,350	Telegraph Constn. and Maintce., Ltd.	12	20 %	20 %	15 %	38 — 41	38 — 41	40	39½
150,000	Do. do. do. 5 % Bonds, red. 1899	100	5 %	5 %	5 %	104 —107	102 —105xd	...	...
54,000£	Waterloo and City Railway, Nos. 1 to 54,000, £6 paid ...	10	...	...	...	8 — 8½	8 — 8½	8⅜	8⅛

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ Last dividend paid was 50% for 1890.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

Crompton & Co.—The dividends paid on the ordinary shares (which have not a Stock Exchange quotation), are as follows: 1892—0%; 1891—7%; 1890—5%

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Birmingham Electric Supply Company, Ordinary of £5 (fully paid), 5¾—6¼.

Electric Construction Corporation, 6 % Debentures, 104—106

House-to-House Company (£5 paid), 4—4½.

Do. do. 7 % Preference, of £5, 8⅛—8⅜.

Do. do. 4½% Debentures of £100, 108—110xd.

Kensington and Knightsbridge Electric Lighting Company, Limited, Ordinary Shares £5 (fully paid) 9—9½; 1st Preference Cumulative 6 %, £5 (fully paid), 7⅞—8¼.

Liverpool Electric Supply, £5 (fully paid), 7⅞—8¼.

London Electric Supply Corporation, £5 Ordinary, ⅜—1½.

Yorkshire House-to-House Electricity Company, £5 Ordinary Shares fully paid, 7½—8.

Bank rate of discount 2 per cent. (February 22nd, 1894).

ARC LIGHTING FROM ALTERNATING CURRENT LIGHTING STATIONS.

By FRANK LEWIS.

Of late years, the opposition to arc lighting with alternating currents for street illumination has considerably lessened, owing, mainly, to the advantage being recognised of using the same plant for public or private lighting. There are, however, other advantages besides simplicity. The usual system with alternating current lighting is to run each lamp from a separate converter, or compensator converter, thus making each lamp independent of any other. This is a great advantage, as the failure of a whole circuit with a considerable number of lamps, owing to the non-action of the automatic cut-out, is an experience which, at some time or other, most engineers have gone through who have had charge of lamps run on this system.

If continuous current lamps are used in an alternating station, either the alternating current is commutated, or separate continuous dynamos used for the public arc lighting, the lamps being run in series. I think there is no doubt that a continuous current lamp using the same power throws more light on the ground, where it is required, than an alternating current lamp, though with a reflector plate of sufficient size the difference should not be more than 25 per cent. The diffusion of light from an alternating arc is much better than from a continuous current arc, thus it requires less diffusing effect in the globe in the former case. The smaller the diffusion produced by opalescent or other diffusing globes, the smaller the loss of light. The difference of light is, for these reasons, not so marked as is generally supposed. It is also certain that, when the supply is alternating, we can, owing to the higher efficiency of an alternating current arc lighting system, afford to use more power in the lamps than in those run either with a commutated alternating current, or with separate machines, and thus obtain nearly the same light in either case, more especially when one considers, over and above the increased efficiency, the enormously reduced superintendence required, a point of even greater practical importance.

The capital cost of an alternating or a commutated system is about the same, that of separate machines being greater than either.

There is also another question, that is, the distance of lamps apart. With a series system it is not possible to increase the pressure to such an extent as to have more than a certain number of lamps on each circuit, and it is not advisable to increase the number of circuits indefinitely. With alternating current it is possible to place as many lamps on one circuit as you desire, without increasing the pressure, and it is therefore possible, in lighting a given area, to use more lamps, consuming, for the same area, less energy, and having by this means an area much better lighted. The only question is to find the extra capital cost of placing more lamps of less power, and finding whether this extra capital cost is outweighed by the saving in working.

If we used a quarter the power and double the number of lamps, at the expenditure of half the power in lighting a given area, we should obtain nearly twice the light at the points of minimum illumination. It is true that the efficiency of small current arcs is not quite so high as that of large current lamps, but there is not much difference. The cost of carbons with a large number of small current lamps, would be slightly higher, and also the cost of trimming; but these are not a large item, in fact, small, compared to the cost of the current. I believe the capital cost would come out, with double the number of lamps, 50 per cent. higher than at present. This extra cost would be amply saved by the reduced working cost, and the light obtained would be better. The posts used should be about 15 feet high. The lamps are best run from the ordinary low tension network used for private lighting. When no low tension network exists, and a converter is used for each consumer, a special main is required for the arc lamps, and a converter is placed

in each post to reduce the pressure to that required by the lamps. In the case where a low tension network exists, it is best to switch on each lamp separately; the cost of so doing is very small, when the switch is arranged so as to be easily accessible. The switch should be so constructed as to be operated with a key through a keyhole in the door of the post. The converter, or compensator converter, should be wound to give the actual pressure required at the terminals of the lamp. It is certainly a mistake to use converters giving about 15 volts too high a pressure in conjunction with a choking coil, as although the choking coil wastes very little energy, it is overloading the alternators just as much as if it were real instead of apparent power. In fact, the extra coal expenditure for the street lamps during the night is extremely small compared to the expenses of running more alternators, which is the result of having a small power factor in the lamps* and circuit generally. The objection to using the actual, or nearly the actual pressure required for each lamp, consists in the rather large current which is produced on switching on the lamps. If, however, a compensator converter is used, in which at overload, which occurs momentarily on switching on, a considerable drop is obtained, this objection is obviated. A compensator wound on a non-closed iron circuit will drop thus, owing to the leaking of magnetic lines. Its efficiency will be as high as if close-circuited at full load, the only load at which it is used, and its power factor will be approximately unity.

The effect of wave form on the efficiency of lighting is perceptible, an approximate sine curve being the best. The wave form, however, is not very important, as the transformation by converters tends to produce the flat top curve form; and, also, according to a recent article in the *Electrician*, the arc itself has this tendency.† I had the opportunity of seeing street lamps in practice being run sometimes from a machine giving an approximate sine curve, and at other times from machines giving peaky curves. The lamps were run from a 2,000-volt main with a converter to each lamp to reduce the pressure to 50 volts, a choking coil being then used to obtain the required lamp terminal pressure. I thought, though I could not be certain, that the light was better when the sine curve machine was used; the difference, however, must have been very slight.

In conclusion, there is one observation I should like to make about both continuous and alternating arc lighting, though it is far more important in alternating lighting, with respect to the carbons used, a difference of 50 per cent. in the light resulting from the use of inferior carbons. I have often noticed that corporations advertise for tenders for carbons, accepting the lowest, and leaving the question as to whether they are suitable for their purpose out of consideration.

REGULATIONS FOR FITTING UP CONSUMERS' PREMISES.

Mr. C. H. Wordingham, City Electrical Engineer, Manchester, contributed to the M.E.A. a lengthy paper dealing principally with the subject of regulations as to the carrying out of the work in consumers premises, and the inspection of the same. He cited the clause in the provisional order in which corporations and companies rely upon their authority to accept or refuse any installation, the terms of which are ambiguous. Undertakers are not compelled to give a supply of electricity to a consumer unless they are "reasonably satisfied" that the electric lines, fittings, &c., are in good order and condition, and not calculated to affect injuriously the use of energy by the undertakers or by other persons.

As was evidenced by the discussion, Mr. Wordingham caused a flutter among the consulting engineer fraternity present by emphatically advocating the principle of corporations constituting themselves, through their engineer, an advisory body (not, as he tried to explain, to the detriment of the consulting engineer, but by insisting upon the consumer availing himself of an expert adviser, not *necessarily* the corporation's engineer). The practice of the every-day consulting engineer would in the long run, he thought, be largely increased. This may be, but as one of the consulting engineers present observed, and not without reason, the corporation engineer has sufficient to occupy his time in his own domain, and he thought installation work would be better controlled if left in the hands of qualified gentlemen like himself.

The consulting engineers, as well as the engineers employed by corporations, should be men who have spent some years at the work in which they profess to be experts. How many corporation engineers have put up with their own hands a single incandescent lamp? How can a man have the audacity to claim to be the best qualified person to give an advice on a matter in which he has no practical knowledge whatever? Are those members of the Municipal Electrical Association consulting their best interests by publicly claiming, and that in the presence of their employers, to have sufficient spare time to enable them to begin the practice of consulting engineers, after having bound themselves by agreement to devote the whole of their time and attention to the multitudinous duties inseparable from a central station? Are the members of the different committees and corporations who heard and read the published reports of the papers and discussions to be blamed if they ponder over the points raised in Mr. Wordingham's paper, and the opinions expressed in the discussion which followed with reference to the dissatisfaction caused by too little work and too little money? As Mr. Wordingham clearly stated in his reply, "no responsibility to the corporation would be involved by the control and inspection of the wiring, and the engineer would be in the position of an ordinary consulting engineer, and would not go on behalf of the corporation;" hence it is natural to assume that all fees collected for inspection and advice would go to the engineer. Members of electric lighting committees and corporations are hard-headed men of business, and we venture to think that having engaged engineers to superintend the central station, extensions of plant, and mains, &c., duties which until now were considered sufficient to occupy the whole of the time of men who conscientiously do their duty, and who, in most cases, are liberally remunerated, they are not likely to be so easily won over as to allow their engineers to engage in practically private work. We admit that the advantages of employing a skilled engineer to superintend the work of installations is incalculable, but if corporations wish to take upon themselves this responsibility, let them by all means employ a specialist at a fixed salary, the balance obtained from fees, after paying all expenses incurred by this department, being devoted to the lowering of the rates.

A nice point in connection with the above might crop up. If the chief engineer has so much spare time on his hands—the bulk of his work being done by assistants—that he could devote himself to outside duties, would it not be desirable to make a reduction in the staff, and so get rid of the impression that he had too easy a time of it in the station?

The question of drawing up and adopting a standard set of regulations for controlling the fixing and connecting up of consumers' devices supplied from municipal electric supply stations, was advocated in the paper and discussed at length, the opinions being unanimous in that the present system of each municipality having its own rules was inefficient; but what will it avail if, after a uniform set of rules and regulations have been drawn up, they cannot enforce them? A gentleman who took part in the discussion made one or two good points, although the principal aim of his speech seemed to be to provoke laughter. He asked them not to invade the consumer more than they could help; consumers were not likely to be partial to the electric light if at the outset they were presented with an elaborate set of rules and regulations, and told they must employ a consulting engineer at a fee. We did not quite agree with the gentleman referred to when he said "he did not think there is any great necessity for all these rules and regulations; they should be content to let the current go through the meter and be paid for it." Perhaps this remark was intended for a joke, but no one laughed.

* Low resistance carbons have a larger power factor than ordinary carbons; they are, however, slightly more expensive, as they burn away faster.

† "The Effect of Wave Form on the Alternating Current Arc," by Julius Frith, June 12th, 1896.

THE PRACTICAL SIGNIFICANCE OF THE POWER FACTOR.

THE advent of the Langdon-Davies motor has caused the question of the *power factor* to be brought so prominently forward, that we think an explanation of its significance in actual practice may be of interest.

Suppose that an alternating potential difference is applied between the terminals of any circuit whatever, and its virtual value, V, is determined by means of an electrostatic, or hot-wire, voltmeter; and that the virtual current is i. Suppose, further, that the actual power given to the circuit (measured by means of a wattmeter) is W; then, in general, the product i V differs from W.

Let $$W = k\, i\, V \qquad (1)$$

where k is some number, not greater than unity, depending upon the constants of the circuit and upon the frequency of the applied potential difference. The quantity, k, has been called the *power factor*.

If the circuit is non-inductive and contains no capacity, the power factor is unity; that is, the power given to the circuit is accurately measured by the product of the ammeter and voltmeter readings. If the circuit contains either self-induction or capacity, or a combination of the two, the current will not in general be in phase with the applied potential difference. If the current and potential difference are sine functions of the time, and if their difference in phase is ϕ, then

$$k = \cos\phi$$

and equation (1) becomes

$$V = i\, V \cos\phi \qquad (2)$$

This is equivalent to saying that if the current and potential difference were in phase the same power would be given to the circuit by a current $i \cos\phi$. In other words, there is a current whose virtual value is $i \sin\phi$, which does not contribute to the available power. This current is usually called an *idle*, or *wattless* current, and its only effect will be to heat the circuit.

It is obviously *desirable* to make the idle current as small as possible, that is, to make $\cos\phi$ as large as possible.

The estimate of the desirability of making the power factor high depends entirely upon the view we take. There are two interested parties—the supply companies and the consumers. To neither of these is a small power factor beneficial.

The consumer only pays for the power given to his circuit; *he does not pay for the current if he uses an erg meter.* The amount he gets for his money depends solely upon the *efficiency* of his machines. A small power factor is to the consumer of electrical energy a matter of little consequence if his machines do not get heated so as to endanger the insulation. It is perfectly true that the copper losses in the machines depend upon the power factor, and that their efficiencies will suffer to some extent in consequence of a small power factor, but this is shown to be so small in the Langdon-Davies motor (see our last issue) as not to be worthy of consideration. These motors—judging from Prof. Thompson's report—run perfectly cool, and have an abnormally high efficiency. The ¾ horse motor tested by him showed an efficiency 25 per cent. higher than most other alternating current motors of the same output, and an increase of efficiency in the motor is equivalent to a diminution in the price of electrical energy. By using a motor of higher efficiency the consumer will be able to pay more for electrical energy, and still get the same value for his money. To fix our ideas, suppose that the price of a Board of Trade unit of electrical energy for motive power is 4d. A consumer using a motor of 70 per cent. efficiency would pay 4d. for 700 available watt-hours: by using a motor of 95 per cent. efficiency, he could obtain available energy at the same rate, and pay nearly 5½d. per unit.

It is to the supply companies that a low power factor may become a serious item.

A motor whose power factor is only 0·5 demands twice as much current for a given input as one having a power factor equal to unity. This means that the alternators at the central station have to produce nearly double the current corresponding to this output, and also the copper losses in the mains are increased four-fold.

Suppose that a supply company is worked to its utmost in supplying power for motive purposes, the motors being synchronous and working under the condition of minimum current, so that their power factors are unity. On replacing the synchronous motors by induction motors having a power factor of 0·5, the company would be compelled to double the number of alternators, or else replace their plant by an equal number of machines of double the size.

It must be remembered, however, that the power supplied by central stations for motive purposes is necessarily but a small fraction of the total output. A large percentage of the total output is for lighting purposes. Moreover, the power for motive purposes is for the most part required during the day, whilst that for lighting purposes is called for at night. A central station capable of supplying a small percentage of power over and above that required for lighting purposes at their busiest times, would, therefore, have no difficulty in supplying power for motive purposes, irrespective of the kind of motor used. The companies' copper losses on motor circuits would be increased, but it must not be forgotten that the primaries of transformers are always taking current, whereas a motor only takes current when it is being used. The primary of a transformer is always connected with the mains, and for two-thirds of the time will be on open secondary circuit when its power factor has its lowest value; but a motor is only connected up when working under load. It follows, therefore, that an alternating current motor may have a much lower power factor than a transformer without increasing the copper losses in the mains. With motors, it is only the *instantaneous* efficiency of transformation that the supply companies have to consider, but it is the *all-day* efficiency that is of importance with transformers.

We see, therefore, that the low power factor of an induction motor is not so serious a drawback as it would appear at first sight. It would not be a difficult problem, knowing the details of any particular plant, to calculate the extra charge which should be made per unit of electrical energy in order to compensate for the low power factor. This additional charge would certainly not increase the cost of the energy available for the consumers' use in the case of a ¾ H.P. induction motor of 95 per cent. efficiency, even if the power factor were comparatively low.

ELECTRIC MOTORS IN BLEACHING WORKS.

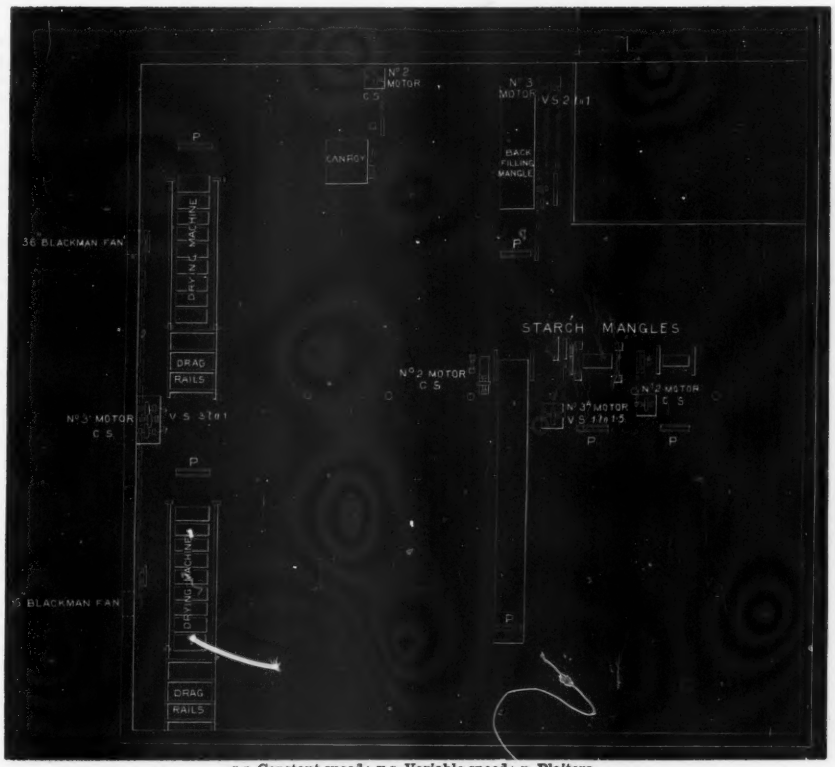
A VERY interesting example of the efficiency and flexibility of an electric motor system exists at the bleaching works of Messrs. A. J. King & Co., Ingersley Vale, Bollington, near Macclesfield. Through the courtesy of the proprietors of the mills, and Messrs. Mather & Platt, we had recently an opportunity of inspecting the plant and witnessing the successful working of the motors under very varied conditions. It is interesting to mention, in view of the recent discussion on water-power obtained from low falls, that the power for driving the electric generating machinery is obtained almost entirely from the River Bollin, which runs past the mills.

The water is dammed back, and provides sufficient power to drive a 60-feet water-wheel, the equivalent horse-power obtained from the wheel being 120. One 50-H.P. generator is driven from a counter shaft, and it furnishes electrical energy for the motors, as well as for lighting.

Bleach works, on account of the peculiar processes adopted, are as little like other factories as they can be, and it says a good deal for the adaptation of electric motors that they have been applied to bleaching machinery, with signal success. It ought to be mentioned that the plan gives only a part of the mills, the motors being at present confined to one or two rooms. Previously, and still to some extent, power was applied to the machinery by shafting and small steam engines. We need hardly insist again on the great waste of steam that accrues to separate engines and their attendant long lengths of steam pipes. It has been shown over and over again that sufficient steam is wasted in some factories to make the difference between a considerable

loss on the undertaking and a fairly large profit. The proprietors of the bleaching mills of which we are speaking have apparently appreciated this fact, and with an economical use of the available water-power, there should be a marked difference in the cost of power. It is the separate steam engine that has been supplanted by the motors, almost all the engines being replaced by motors of much greater efficiency and occupying much less room. There are altogether 11 motors of varying power driving the different machines necessary in the somewhat intricate operations of bleaching. As far as we could see, the processes call for extraordinary variations of speeds, even the same machines being run at widely-differing speeds, according to the operations they are called upon to perform. To give an instance, the drying machines have fairly thick cloth occasionally passing through. Obviously, this will take more drying than thin cloth, consequently on a thick cloth day the machines would be running slower than when thin stuff was going through; occasionally the speed may be 66 revs. per minute, and at other times 190. Such variation necessarily calls for some form of change gear, but with the electric motors the alteration in the speed is obtained by regulating the fields of the motors with much greater efficiency and simplicity. Four different rates of speed are accomplished by this means. The motors are in all cases shunt-wound, and are neatly boxed in. One of the most interesting applications was the driving by motors of two starching machines, with which are combined large drying cylinders. Passing from this to what is technically known as the finishing croft, we come to several machines being driven by motors. On the right of the room, or on the left of the plan, are two motors of 3 H.P., each driving two horizontal drying machines, which require great variation of speeds. On the wall is a small motor of 3 H.P., driving two Blackman air propellers, which draw 14,000 cubic feet of air per minute. On the other side of this room a motor of 2 H.P. is driving a mangle, and next to this a 6-H.P. motor, driving a brass roller mangle. There are other smaller motors, one of 1 H.P., driving another starching and drying machine, one driving a canroy, and a ½ H.P. driving a sewing machine. There are three power circuits, there being three motors on each circuit, separate circuits being used for lighting. The whole works are lighted with incandescent lamps, the current for which is obtained from the same generator as the power current.

We must express our thanks to Mr. King for permission to inspect the machinery, and to Messrs. Mather & Platt for information and assistance in compiling these particulars.



C S, Constant speed; V S, Variable speed; P, Plaiters.

BLEACHING MACHINERY DRIVEN BY ELECTRIC MOTORS.

TELEGRAPH MATTERS AT THE CHAMBERS OF COMMERCE CONGRESS.

AT the third Congress of the Chambers of Commerce of the Empire, held at the Hall of the Grocers' Company, Prince's Street, Bank, E.C., under the presidency of Sir Albert K. Rollit, telegraph matters were considered at length. The following discussions took place on the third day, June 11th:—

INTER-IMPERIAL POSTAL AND TELEGRAPH ROUTES.

Mr. J. X. PERRAULT (Montreal Chamber of Commerce) moved the following resolution:—

"Whereas an extension of direct telegraphic communication throughout the Empire would considerably facilitate and increase the commercial relations of the mother country and her several colonies, and be also a source of security and strength in maintaining uninterrupted hourly communication in time of war; and whereas the Atlantic and Canadian systems now extending to the Pacific coast offer special advantages over all other routes, to establish direct telegraphic communication between the mother country and Australia through uninterrupted British territory:—Be it resolved that, as an alternate and direct line of communication, a cable should be laid between Australia and Canada without further delay, the Imperial and Colonial Governments directly interested being respectfully requested to offer such inducements to the constructing company as may determine the laying of the Pacific cable at the earliest possible moment."

Mr. Chairman and Gentlemen,—Four years ago I had the pleasure of presenting the same resolution, but at that time the information was not complete, and it was then decided to postpone the consideration of the question. I am glad to say that since that period a considerable amount of work has been done. Soundings have been taken, estimates have been made, tenders have been received, and the whole scheme is now in a practical shape. Thanks to our distinguished statesman, our late Prime Minister, Sir Mackenzie Bowell, whom I am glad to see here, the Australian colonies were seen by these gentlemen, and brought to the conclusion that a telegraph system through the Empire, and through Imperial territory, was a most desirable thing. Thanks also to the distinguished statesman of Australia, Mr. Reid, whose elcquence is well known in this meeting, the same compliment was returned to Canada, and the people there

were equally convinced that the application of a large sum of money to the construction of a Pacific cable would be a good investment. A conference is about to sit in London on the subject. The leading men of the Empire have been sent here, and we have every prospect of seeing this great scheme carried out. In fact, in a meeting like this, composed of business men, there can be no two opinions that the heart of the mother country should throb to the extremities of the Empire, not only when business is wanted, but at every minute, night and day. At any moment we may have war; at any moment we may have difficulties, and if the other cable were to be cut, we could rely on the Canadian cable going to Australia to secure communication with the War Office and with the Imperial Government. I need not occupy your time in elucidating this question. I know that Mr. Reid will be kind enough to support the proposition, and he will, much better than I can, explain all the advantages of a cable which will unite us in a short time with our Antipodes and with Canada.

The Hon. Robt. Reid (M.L.C. Victoria): At the risk of forcing my speeches upon you, I have consented to second this resolution, as I have taken a great amount of interest in the subject for some considerable time. Two years ago I was sent as a delegate from my Government to interview the Central Government then in power in this country, Lord Rosebery, and they listened with very great attention, and took a keen interest in the case as presented to them. You have already heard from the proposer of this resolution that we look upon the object as almost accomplished. There is no doubt that it is of supreme importance to the commerce of the British Empire. All the other cables that communicate with the East pass through foreign countries, and have to be interpreted sometimes into two or three languages, so that this communication by the West to the East is one of the most important things that we could pass a resolution in favour of. I do feel myself that in that far-off land trade is springing up, and that the Pacific in the near future is going to rival those other oceans on the earth's surface in the volume of its trade. You have no idea how rapidly things grow in those far-off portions of the world; and every merchant and manufacturer in this country is personally interested in seeing this cable completed, and that without delay. We know its cost, but when we talked about it years ago, it looked like so many millions of money; but we have actually received tenders now that this object is so near accomplishment. I feel we owe a debt of gratitude to a distinguished ex-Premier of Canada for the statesmanlike view that he took on this subject, and his name will be handed down in history as the one who stood out and took this matter firmly in hand. I think it is only due to him to mention that fact. We have, of course, the Imperial Government calling this conference, two members from Australia, and two from Canada, with some who are connected with Imperial affairs here, and we look forward with great interest with a hope in a few weeks of seeing this matter settled and solved, and speedily brought into operation. I cordially second the resolution.

Sir Mackenzie Bowell (Canada): It is not my intention to discuss either the feasibility or the necessity for the construction of this cable; I rise merely to suggest to the mover the elimination of a few words by which it would leave the proposition open for the Imperial and Colonial Conference which is to meet, and has met and organised, and will resume its duties as soon as the Australasian delegates return from Buda Pesth, where they have gone, in accordance with the command of their Government, to look after the postal and telegraphic arrangements. I notice that this resolution proposes that "the Imperial and Colonial Governments, being directly interested, be requested to offer such inducements to the constructing company as may determine the laying of the Pacific cable at the earliest possible moment." What I suggest, Mr. Chairman, is this, that the words "to the constructing company" be omitted, and the resolution will then read, "That as an alternate and direct line of communication, a cable should be laid between Australia and Canada, without further delay, the Imperial and Colonial Governments directly interested being respectfully requested to offer such inducements as may determine the laying of the Pacific cable at the earliest possible moment." There are two or three propositions which will be considered by the conference about to meet to discuss this very important Imperial and Colonial subject. There are those who believe that a cable of this character, which is intended to be exclusively British—that is, running through exclusively British territory—from one portion of the British Empire to the other, could be constructed, owned, worked, and managed by the different Governments. The reason for that proposition must be apparent to anyone who will give the subject a moment's thought. If it be laid by a company, those who invest their money in an enterprise of this kind must expect to receive something for it. If it is placed in the hands of promoters, they must anticipate making a certain amount of money out of the operation. If, however, it is constructed by Governments exclusively, whether by the aid of the Imperial Government, or by the Colonial Governments alone, there is no possible object that those Governments can have, other than to provide telegraphy to the commercial world at the cheapest possible rate, consistent with the raising of a sufficient sum of money to pay the interest upon the investment. There will be no speculative promoters to pay; there will be no striving after the large amount of receipts which must come out of the commercial community if the cable is laid by a company, and by private funds. I merely throw out the suggestion to this Chamber in order that you may well consider the matter. No doubt you will do so, for you are all commercial men, and commercial men looking to their own interests will endeavour to obtain as cheap a rate as possible. I do not desire to enter into particulars upon a question of this kind, but I could give illustrations of my own experience in Australia. A few years ago it was an enormous expense to those who had any telegraphing to do with the mother country. Fancy a gentleman who was with me upon one occasion having to pay £2 11s. 5d.—10s. of which was for the registration of his name—in order that an answer should be sent to his hotel when he arrived, and the whole cable communication was simply the name of a party in Canada, the state in which he lived, and two additional words! Now, if such a rate is imposed by any system that is in existence, it certainly must hamper to a very great extent commercial transactions between the different portions of the Empire. I am of those who, while believing the old adage of trade following the flag to be literally true, am also convinced that at the present day, with the means which we have of completely obliterating time by the agency of electricity, it is as necessary to have an electrical communication between different portions of the Empire as it is to have the ships in which to do the business. I hope my friends, the mover and the seconder of the resolution, will consent to the omission of the words as I suggested, so that the question may be left open to the members of the Congress which is about to sit in a week or two, in this city, in order to consider not only the advisability, as I have already said, but the practicability, and the actual working out of the scheme.

The Chairman: Will Mr. Perrault consent to the alteration?

Mr. Perrault: With the consent of Mr. Reid I will accept it.

The Chairman: The resolution as it now stands is as follows:—"That as an alternate and direct line of communication, a cable should be laid between Australia and Canada, without further delay, the Imperial and Colonial Governments directly interested being respectfully requested to offer such inducements as may determine the laying of the Pacific cable at the earliest possible moment."

Mr. William Adamson (Singapore Chamber of Commerce): I shall only detain you a very few minutes, but I may mention that the subject generally of telegraphic communication has very great interest for my Chamber. We feel that the charge which is made upon us is excessive, and we have very little means of getting it reduced. We are, therefore, in the hands of the monopolist company. I would remind the Congress that at the very first congress we had this question was raised, and that like the farmer with his landlord's claret, we do not seem to get "any forarder." We are, as I said, quite unable to make the slightest impression upon the telegraph companies to the Far East; but in 1886 we made an appeal to them, and they stated that they had then made certain reductions, which amounted to £100,000, and that they must wait and see whether the traffic would grow up sufficiently to pay for the reduction. Now, 1886 is a long time ago. We have all had the opportunity of seeing the accounts of these telegraph companies from time to time. We know that these telegraph companies are extremely prosperous, but we do not find that they give the least concession to their customers unless they are compelled to do so. In Australia you have given them a large Government subsidy, which in the first year resulted in a very considerable loss to the Colony, but I understand that the progress of trade and the inducements given to telegraphy by the reduced rates which you have been able to give, have been such that the loss has come down to a nominal amount. But I would say that if we can only get a reduction of our rates by Governments coming forward and giving large subsidies—a still better plan would be for the Governments to take these lines of cables, these great lines of communication, into their own hands, and I believe that would facilitate that union of the Colonies and the Dependencies with the mother country (of which we heard so much yesterday), and the sentiment which we so cordially approve. When I tell you that 20 years ago we paid in Singapore $1.20 per word for telegraphing to England, and that we now pay $2.90 a word, you can understand the importance of this question upon trade. I should like to explain that the great advance which has taken place is due to the fall in silver, but at least you will note this: that we have had no reduction during these 20 years. I would also mention this further point, which was brought out by Mr. Reid in speaking of the matter. He said that when the project first came forward of uniting Canada and Australia by cable it was believed that the cost would be several millions sterling; but now a cable can be got for much less money, and we must bear in mind that while we are charged these heavy rates on our trade to the Far East and China, we are paying an amount as dividend on the cost of cables which would be very much greater than those cables could be laid for to-day. I have very great pleasure in supporting the resolution which is now before us, because I think it is one step towards freeing ourselves from a great monopoly. It would be a great advantage to commerce generally, to Australia and to Canada, and I think this meeting ought cordially to support the resolution which is now before it.

The motion was then put from the chair and carried unanimously.

Mr. B. Plummer (Newcastle and Gateshead Chamber of Commerce): Mr. President and Gentlemen,—The resolution standing in the name of the Newcastle and Gateshead Chamber of Commerce, I need hardly say, was put upon the programme previous to your knowledge of the Canadian resolution which you have just passed—and I think very properly passed. My resolution goes still further. Whereas the resolution you have just passed applies to Canada and Australia, the resolution we have on the programme is of a more general character, and compromises the whole Empire. The observations that I might have felt called upon to address to you on this subject have been considerably shortened, I think, by the approval which the general idea received at the hands of our President in his opening speech, and also in a leading article which appeared in the *Times* of yesterday. I believe the advantages of the resolution, if thoroughly carried out, must be self-evident. They are of two characters—the same as most of the resolutions; particularly that which we heard so much talk about yesterday and the day before—the sentimental advantages or reasons why it should be carried out, and the material benefits which will be achieved by it. The Canadian and Australian cable has just been referred to, and the speakers have said nearly everything that I should have been called upon to say, had their resolution not preceded mine. It contemplates a very great deal, certainly more than half, of what the resolution I am proposing now contemplates. But there still is something to be done. I agree with the last speaker to a great extent, that it would probably be

better if these cables joining different parts belonged to the Empire, and not to speculative companies. In that way, perhaps, this resolution leads in that direction. It is not only with reference to commerce, but defence, that I think these cables will be of very great benefit. It was stated in a discussion in connection with the cable to Australia that, in case of there being any complications, the mere fact of telegraphing two words, "War declared," would be a sufficient recompense to those Australian Colonies by giving them warning, and that it would be a sufficient recompense for the whole expenditure that there might have been upon the cable, even if the accident happened of the cable being fished up and destroyed by hostile cruisers. I do not know that I need trespass upon your time, Mr. President, any longer. I have great pleasure in moving the resolution: "That, so far as possible, it is most important that inter-Imperial postal and telegraph routes should be established between this country and the Colonies, as well as between the Colonies themselves, without such routes passing through other countries."

Mr. John Coates (Ottawa Board of Trade): I have great pleasure in seconding the resolution. I think it has been governed by the discussion on the previous motion; still I think, as the mover has said, we might go a little further. It is said that an ounce of fact is worth a ton of theory. I live in Ottawa, and have been living there for some time; but I have a great deal of business with Australia, and I have to send my cables through America to London, and from London to Melbourne. I think that the loss on the new cable line—supposing it is a little loss—would be compensated by the tremendous advantage we should gain by sending our cables through British territory, because if any interruption took place at any moment through war, and after all there is a great deal more in the question of a war in America than people think—I have been in America a great deal lately—if any interruption took place, it would be a very serious thing indeed.

Mr. Ross (New Zealand): This is a subject of which the importance and advantage is so well understood by every gentleman in this assembly, that it would be a work of supererogation to say anything more in favour of it. I shall merely content myself by supporting the resolution which has been proposed.

Mr. C. Washington Eves (Royal Jamaica Society of Agriculture and Commerce and Merchants' Exchange): The completion of the links necessary to bind together the mother country and our various Colonies, appeals most strongly to the British island which I am here representing—Jamaica. Inter-colonial and direct communication has long been a vital question to the West Indies, and it was proposed at the second Congress of the Chambers of Commerce in 1892, and then considered so obvious in itself as not to need discussion. It has been the work of the West Indians to try and secure the completion of a cable from the Island of Bermuda to Turks Island, and thence to Jamaica. It has been generally discussed throughout the West India Colonies, and its extreme necessity has been for many years brought continually to the notice of the Home authorities. It is necessary for the cementing of interests of Canada, as well as those of Great Britain, and the attention of the people of Jamaica, and the whole of the West India Islands will be given to this required link in our communications until it has been carried out, and that it should be completed in the most expeditious manner is obvious. We know that the Commander of the Forces recently said that it was necessary, if the defence of Jamaica, and consequently all our other British West India possessions, were to be adequately maintained in time of war. We know that during the present insurrection in Cuba the lines were cut and the communication to our colonies was dependent upon passing through many more foreign countries than they do in normal times, when they are controlled by the United States, France, Spain and Denmark. All these countries and those in Central America are more or less antagonistic to British and Canadian interests, and we learn and know ourselves that the absence of protection which we look for from our Government has caused some surprise and alarm, and the colonists are not satisfied that this most important link in the chain of Imperial communications should remain in abeyance, and that its general advocacy for a great number of years should be futile. We in London representing West Indian interests have and are supporting the laying of this cable, and every day the subject obtains new adherents and support. The West Indians have been strengthened by support from important cities in Canada, most of which have either passed favourable opinions or have given effect to resolutions enjoining upon their Government urgency, and the Maritime boards of the Dominion look for recognition in this direction. To show the responsibility of the colony I represent, it has stated its willingness to assist the Imperial Government in the undertaking for the establishment of this cable, and it has done this not only because it is alive to the needs I have to mention, but also because of the prohibitive rates. There are none in any part of the world more prohibitive. I do not think I am misstating this fact. They retard the development of business, and render more acute the difficulties of commerce. The commercial interests of the island of Jamaica—and I can quote no better authority than opinions expressed in the Jamaica Legislative Council by the colonists and by the press—under the present depression of markets are seriously prejudiced by the want of economical means of telegraphing which would enable us to more thoroughly grapple with existing commercial exigencies consequent on depression of trade and competition. The difficulty cannot be met otherwise than by the extension of a duplicate and more economical line, so that we may resort more frequently to its use. There is also a misdirection of trade at present which would sooner or later, and by easy stages, be remedied, and in time probably eliminated by a line passing over entirely British territory. It is well known that the trade between Canada and the West Indies and British Guiana, even in proportion to population, is unimportant. It is probably about one and a half million pounds sterling. On the other hand, that to the United States of America in normal times is probably more than thirty millions in value. It may be said that part of this is Canadian and British produce, but it is little satisfaction to know that the carrying trade should be thus lost either to Britain or to Canada, and it is less satisfactory that a middleman should come into business which should be transacted direct. It is also well known that commerce follows lines of communications. The free use of cable is always productive of increased trade, and if such a line as that between Halifax and Nova Scotia and the West India Islands be laid, there must follow an appreciable advance of intercolonial business, such as will repay many times the establishment of such a service. It is evident, therefore, that as the safety of our possessions depends upon the laying of this cable, and its importance has been accentuated by recent international complications which are not yet settled, and also as it is generally demanded by reason of commercial exigencies, any resolution likely to bring about its realisation must receive unreserved support not only from myself and all others connected with the West India Islands, but from the delegates of this Congress. There comes into the question, also, that of mutual interests between the colonies and the mother country which can have no other effect than that of more closely binding them together, and when the colonies pledge themselves to carry out their part of the work, the benefit of which would be enjoyed by this country as much as by themselves, there can be no reason for hesitating in bringing about a solution, and I am deputed by the colony I represent to employ all means to obtain such a solution as is in accordance with reason and necessity.

Mr. J. J. Wilson (Kendal Incorporated Chamber of Commerce and Manufacturers): I think as a Chamber of Commerce in considering this matter of intercommunication, we ought to consider it entirely on a commercial basis. We look for the protection of this country to wise statesmanship, and to the tact and judgment which characterise the English nation, and I think it would be a great pity if we passed this resolution in a spirit of fear of a time of war, and not in a spirit of real commercial interests, which we are all met here together to promote.

Mr. Edgar Tripp (Trinidad Chamber of Commerce): It appears to me that whether in time of war or in time of peace, there can be no doubt as to the desirability of direct telegraphic communication between this country and its colonies and dependencies. It is in a time of peace that we should be prepared for what may occur and what would occur in time of war if we were not so connected. I have very great pleasure in supporting what has been said by Mr. Washington Eves with regard to the want that is felt in the West Indies of direct communication through British territory, and I am pleased to see from a communication that has just been put into my hands that only recently in the House of Commons the Secretary of State said:—"I have received communications from the West Indian Colonies representing the importance of establishing improved telegraphic communication between this country and those colonies for the purpose of Imperial defence as well as for commercial purposes. I have no reason to think that there are any insuperable constructive difficulties in effecting such communications." I am pleased, indeed, to see that the efforts which have been made during several years by the Chambers of Commerce of British Guiana, Barbadoes, Jamaica, and Trinidad are apparently about to bear such good fruit. We are at present supplied with telegraphic news by the West India and Panama Company, which is purely a local company in those waters connecting the West Indian Islands generally, but which is dependent for its communication with Europe upon lines which pass through the Spanish Island of Cuba, the Danish Island of St. Thomas, and, in the event of one line breaking down, through the two French Islands of Martinique and Guadaloupe, so that our communication with England depends upon our being friendly with the whole of those four nations. The most serious feature of our want of direct communication is that we are not so much dependent for our telegraphic communication upon the goodwill or friendliness, for the time being, of the Governments through whose territory the lines pass, as upon the rings of America. There is, I believe, a great telegraphic trust, known as the Western Union; and that the Western Union dominates, to a great extent, the British line with which it connects, is undoubted. I do not wish to detain you long, but I should like to give you one little instance which I think proves this conclusively. Some years ago the well-known Mr. Jay Gould, who, I believe, controlled this telegraphic ring in America, passed through the West Indies in his yacht. He stayed several days at Trinadad. He came ashore, entered our British telegraphic office, sat down there every morning for about two hours, and talked with his office in New York free of charge! Every British message in Trinidad had to wait by special instructions to the officer in charge of the British telegraphic station whenever Mr. Jay Gould, the American monopolist, desired to speak over our British lines. That is a line upon which the British Government depends for its communication with British fleets if they may happen to be in West Indian waters, in case we happen to have any trouble with the United States. Again, gentlemen, as you are aware, there has been a large coaling station and military entrepôt established at St. Lucia. The whole of the British troops in that part of the world are to be established there, and the process is already commenced, so that it is all the more necessary that communication should be of a character that the British Government should have some control over it. Now, there is another company that has already a line between Halifax and Bermuda—the Halifax and Bermuda Company. I am not advocating the claims of any special lines, but merely what is of interest to our colonies. That company has already established a communication between Halifax and Bermuda. There is only now a short line of communication desired between Bermuda and Jamaica to place the whole of the West Indian islands in direct communication throughout territory controlled by Great Britain, and it is in favour of that piece of line being laid that the Chamber of Commerce of the West Indies has been pressing for many years, and I hope, at last, with some prospect of success. Our rates at present are 10s. 5½d. per word, which, except

for very important messages, as you will understand, is a price which is practically prohibitive. This, we understand, if this direct communication were established, would be very considerably reduced. There would, of course, be some questions about subsidies and matters of that sort between the different colonies, but I think that point would be comparatively easy of adjustment within the next few years. I have the greatest pleasure, therefore, on behalf of the Trinidad Chamber of Commerce, and also on behalf of the representatives of British Guiana and of Barbadoes, who are at the table and have authorised me to speak for them, to support the motion that has been brought forward by the representative of Newcastle and Gateshead.

The resolution was then put from the chair, and unanimously agreed to.

INTERNATIONAL TELEGRAPH CONFERENCE, BUDAPEST, 1896.

List and Addresses of Government Delegates and Representatives of Telegraph Companies.

MM. Ernest Daniel de Szamosujvár-Németi, Ministre du Commerce, Palais du Ministère Viziváros, Láncshid-utcza 1.
László Vörös de Farád, Secrétaire d'Etat, Palais du Ministère Viziváros, Láncshid-utcza 1.
Rothen, Directeur du bureau international de Berne, Hôtel de l'Archiduc Etienne.
Eschbaecher, Vice-Directeur du bureau international de Berne, Hôtel de l'Archiduc Etienne.
Homberger, Fonctionnaire au bureau international de Berne, Hôtel de l'Archiduc Etienne.

Country.	Delegates.	Addresses.
Allemagne ...	M. Fritsch, Directeur au Département des Postes de l'Empire d'Allemagne, délégué	Hôtel de l'Archiduc Etienne
	M. Billig, Conseiller intime au Département des Postes de l'Empire d'Allemagne, délégué	" "
	M. Le Sage, Conseiller supérieur des Postes de Bavière, délégué	" "
	M. Barth, Secrétaire des Télégraphes, fonctionnaire attaché	" "
République Argentine		
Australie méridionale	Hon. Thomas Playford, Agent Général de la Colonie à Londres, délégué	Hôtel Hungaria
Australie occidentale	Honourable Sir Malcom Fraser, K.C.M.G., Agent Général de la Colonie à Londres, délégué	" "
Autriche	M. Le Dr. Rodolphe Neubauer, Conseiller ministériel au Ministère J.R. du Commerce, délégué	Hôtel Roi de Hongrie
	M. Le Dr. Charles Benesch, Conseiller de Section au Ministère J.R. du Commerce, délégué	" "
	M. Le Baron Alfred Fries, Vice-Secrétaire au Ministère J.R., fonctionnaire attaché	" "
Belgique	M. F. Delarge, Directeur Général des Télégraphes, délégué	Hôtel Rémi
	M. Seghin, Chef du bureau de l'Administration télégraphique centrale, fonctionnaire attaché	" "
Bosnie-Herzégovine	M. Arpád Pater, Colonel à l'Etat-major et Chef des Télégraphes de la Bosnie-Herzégovine au Ministère commun imp. et roy. de la Guerre d'Autriche-Hongrie, délégué	Hôtel de la reine de l'Angleterre
Brésil	M. Alvaro de Mello-Coutinho de Vilhena, Ingénieur, Vice-Directeur au Département des Télégraphes, délégué	Hôtel Bristol
Bulgarie	M. Ivan Stoyanovitch, Directeur Général des Postes et des Télégraphes, délégué	" "
Cap de Bonne-Espérance	M. J. C. Lamb, C.B.; C.M.G., Secrétaire du Post Office de la Grande Bretagne, délégué	Hôtel Hungaria
	M. H. C. Fischer, C.M.G., Directeur au Post Office de la Grande Bretagne, délégué	" "
	M. P. Benton, Directeur-adjoint du Bureau de la Comptabilité du Post Office de la Grande Bretagne, délégué	" "
	M. R. J. Mackay, fonctionnaire attaché	" "
Cochinchine ...	M. Arnaud, Inspecteur des Colonies, délégué	Hôtel Royal
Danemark ...	M. Von Höncke, Lieutenant Colonel, Directeur des Télégraphes, délégué	
Egypte	M. E. A. Floyer, délégué	
Espagne Colonies espagnoles	M. Le Duc de Ripalda, Marquis de Lema, Directeur Général des Postes et des Télégraphes, délégué	Hôtel Bristol
	Don Primitivo Miguel Vigil y Lopéz Posada, Directeur de Section au Département des Postes et des Télégraphes, délégué	"
France	M. Raymond, Administrateur des Postes et des Télégraphes, délégué	Hôtel Royal
	M. Frouin, Inspecteur-Ingénieur des Télégraphes, délégué	" "
	M. Blanchon, Rédacteur à l'Administration centrale, Secrétaire de la Délégation	" "
Grande-Bretagne	M. J. C. Lamb, C.B., C.M.G., Secrétaire du Post Office, délégué	Hôtel Hungaria
	M. H. C. Fischer, Directeur au Post Office, délégué	" "
	M. P. Benton, Directeur-adjoint du Bureau de la Comptabilité du Post Office, délégué	" "
	R. J. Mackay, fonctionnaire attaché	" "
Grèce...	M. Grégoire Manos, Chargé d'Affaires du royaume de Grèce à Vienne, délégué	" "
	M. Athanase Bassia, Professeur de l'Université à Athènes, délégué	" "
Hongrie	M. Pierre de Szalay, Directeur Président des Postes, des Télégraphes et des Téléphones, délégué	Ministére du Commerce
	M. Sigismond Schrimpf, Conseiller de Section, délégué	" "
	M. Joseph Kiss, Directeur des Postes et des Télégraphes, délégué	" "
	M. Charles Dürr, Directeur des Postes et des Télégraphes, délégué	Direction des Postes et des Télégraphes de Budapest, Rue Granatos
	M. Charles Follért, Directeur des Postes et des Télégraphes, délégué	Ministére du Commerce
	M. François Mokry, Conseiller des Postes et des Télégraphes, délégué	" "
	M. Le Dr. Guillaume Hennyei, Conseiller des Postes et des Télégraphes, Secrétaire de la Conférence	Hôtel de l'Archiduc Etienne
	M. Paul Balla, Ingénieur en Chef, Secrétaire de la Conférence	Ministére du Commerce
Indes britanniques	M. S. P. V. W. Luke, C.I.E., Deputy Director General of Indian Telegraphs, délégué	Hôtel Royal
	M. B. T. Finch, Director in Chief, Indo-European Telegraph Department, délégué	" "
	M. Thomas J. Maltass, fonctionnaire, attaché	" "
Indes néerlandaises	M. J. J. Perk, Directeur au Département des Colonies, délégué	Hôtel Rémi
Italie	M. Le Commandeur Tommaso Picco, Inspecteur Général des Postes et des Télégraphes, délégué	Hôtel Royal
	M. Le Chevalier Francesco Sacconi, Chef de Section au Ministère des Postes et des Télégraphes, fonctionnaire, attaché	" "
Japon	M. Kenjiro Den, Directeur Général des Postes et des Télégraphes, délégué	" "
	M. Takekichi Matsunaga, Conseiller ministériel, Secrétaire intime du Ministre des Communications, délégué	" "
	M. K. Tanaka, attaché au Ministère des Communications, fonctionnaire attaché	" "
Luxembourg ...		

Country.	Delegates.	Addresses.
Montenegro ...		
Natal...	M. J. C. Lamb, C.B., C.M.G., Secrétaire du Post Office de la Grande Bretagne, délégué	Hôtel Hungaria
	M. H. C. Fischer, C.M.G., Directeur, au Post Office de la Grande-Bretagne, délégué	" "
	M. P. Benton, Directeur-adjoint du Bureau de la Comptabilité du Post Office de la Grande-Bretagne, délégué	" "
Norvège	M. Jean Séverin Rasmussen, Directeur Général, délégué	IV., Magyar-utcza 40
	M. Jens Ulric Ferdinand Bugge, Inspecteur des Télégraphes, délégué	"
Nouvelle Calédonie	M. Dalmas, sous-Directeur au Ministère des Colonies, délégué	Hôtel Royal
Nouvelle-Galles du Sud	Honourable Sir Saul Samuel, K.C.M.G., Agent Général de la Colonie à Londres, délégué	Hôtel Hungaria
Nouvelle-Zélande	M. J. C. Lamb, C.B, C.M.G., Secrétaire du Post Office de la Grande-Bretagne, délégué	" "
	M. H. C. Fischer, C.M.G., Directeur au Post Office de la Grande-Bretagne, délégué	" "
	M. P. Benton, Directeur-adjoint du Bureau de la Comptabilité du Post Office, délégué	" "
Pays-Bas	M. J. P. Havelaar, Directeur Général des Postes et des Télégraphes, délégué	" "
	M. A. Kruijt, Inspecteur des Télégraphes, délégué	" "
Perse...	M. B. T. Finch, Directer in Chief, Indo-European Telegraph Department, délégué	Hôtel Royal
Portugal ... Colonies Portugaises	Ernesto Madeira Pinto, Directeur Général, délégué	Hôtel Hungaria
Queensland ...	M. Charles S. Dicken, C.M.G., Agent Général de la Colonie à Londres, délégué	" "
Roumanie ...	M. Constantin Cnivu, Directeur Général des Postes et Télégraphes, délégué	" "
	M. Etienne Dimitrescu, Inspecteur à la Direction Générale des Postes et Télégraphes, délégué	" "
	M. Romulus Preda, Chef de bureau à la Direction Générale des Postes et Télégraphes, délégué	" "
Russie	M. Nicolas Petroff, Lieutenant-Général de l'Etat-Major, Directeur Général des Postes et Télégraphes, délégué	Hôtel Rémi
	M. Michel Mossoloff, Colonel, adjoint du précédent, délégué	" "
	M. Ivanof, Conseiller d'Etat, Chef de la Section administrative des Postes et Télégraphes, fonctionnaire attaché	" "
	Bouroukhine, Conseiller de la Cour, Sous Chef du Bureau des Correspondances étrangères, fonctionnaire attaché	" "
Sénégal	M. Dalmas, Sous-Directeur au Ministère des Colonies, délégué	Hôtel Royal
Serbie	M. Svetozar Gvozditch, Commissaire du gouvernement de la Banque Nationale, délégué	Hôtel Europe
	M. Théodore Stefanovitch Vilovsky, Directeur Général des Postes et des Télégraphes, délégué	IV., Kossuth-utcza 7
Siam	M. le Dr. H. Keuchenius, Secrétaire de Légation, délégué	Hôtel de l'Archiduc Etienne
Suède	M. Charles Erich Gustave Bleckert v. Storkenfeldt, Directeur Général de l'Administration Télégraphique de Suède, délégué	Hôtel Rémi
	M. Maurice Renaud Sahlin, Chef de division à l'Administration télégraphique, délégué	" "
Suisse	M. Conrad Fehr, Directeur de l'Administration télégraphique de Suisse, délégué	IV., Magyar-utcza 34
Tasmanie		
Tunisie	M. le Comte de Turenne d'Aynac, Consul Général de France en Hongrie, délégué	Délibáb-utcza 24
Turquie	M. Melcon Yuzbachian Effendi, Secrétaire Général pour la correspondance internationale à l'Administration impériale des Postes et Télégraphes, délégué	IV., Ujvilág-utcza 14
	M. Fuad Bey, Adjoint du Directeur, délégué	"
Victoria	Hon. Duncan Gillies, Agent Général de la Colonie à Londres, délégué	Hôtel Hungaria

List of Government Delegates not included in Telegraph Union.

Chili	M. Victor Pretot Freire, Ingénieur technique du Gouvernement	Hôtel Cor de Chasse
Ecuador	M. Paul Alphonse Lespagnol	Hôtel Hungaria
Mexique	M. Saturnino Islas, Directeur Général des Télégraphes	" "
Salvador	M. Paul Alphonse Lespagnol	" "
Venezuela... ...	M. Charles Matzenauer, Représentant des Etats Unis de Venezuela	IV., Zsibárus-utcza 2

List of Representatives of Private Telegraph Companies.

Companies.	Representatives.	Addresses.
Great Northern Telegraph Co.	M. le Commodore E. Suenson, Directeur de la Cie	Hôtel Hungaria
	M. F. C. C. Nielsen, Représentant de la Cie à Londres	" "
	M. le Gentilhomme de la Chambre, F. Kioer, Représentant de la Cie à St. Pétersbourg	" "
Anglo-American Telegraph Co.	M. Burt, Directeur de la Cie	" "
	M. Barber, Directeur de la Cie	" "
	M. Carson, Administrateur	" "
Western and Brazilian Telegraph Co.	M. R. J. Reidy, Représentant de la Compagnie à Rio Janeiro	" "
	M. E. S. Hodson, Chef de la Comptabilité	" "
Western Union Telegraph Co.	M. George von Chauvin, Représentant de la Cie en Angleterre	" "
The Cuba Submarine Telegraph Co.	M. Robert Kaye Gray, Directeur	" "
	M. James Scott, Secrétaire	" "
Direct Spanish Telegraph Co.	M. Ch. Gerhardi, Gérant de la Cie	" "
	Senor Don Vicente Coromina, Représentant de la Cie en Espagne	" "
The Amazon Telegraph Co.	M. R. J. Reidy, Représentant de la Compagnie à Rio Janeiro	" "
	M. E. S. Hodson, Chef de la Comptabilité	" "
Spanish National Submarine Telegraph Co.	M. Robert Kaye Gray, Président	" "
	Don Francisco de Paula Vazquez, Représentant de la Cie à Madrid	" "
	M. Henri Mornaud	" "
Commercial Cable Co.	M. George G. Ward, Vice-Président	" "
	M. Eugène Becue, Directeur de la station du Hâvre et Chef du service continental	" "
India Rubber, Gutta-Percha and Telegraph Works Co.	Hon. Henry Marsham, Membre de la Direction	" "
	M. James Jeffery, Administrateur	" "
Postal Telegraph Cable Co.	M. George G. Ward, Directeur	" "
South American Cable Co.	M. J. Y. Buchanan, F.R.S., Directeur	" "
	M. R. K. Gray, Directeur	" "
	M. W. F. O'Brien, Chef de la Comptabilité	" "
The West Coast of America Telegraph Co.	M. J. Denison Pender, Président	" "
The Direct United States Cable Co.	M. E. M. Underdown, Queen's Counsel, Président	" "
	M. F. Moll, Administrateur du trafic	" "

Companies.	Representatives.	Addresses.
Indo European Telegraph Co.	M. W. Andrews, Directeur-Administrateur	" "
	M. F. Moll, Secrétaire et Chef de la Comptabilité	" "
The West India and Panama Telegraph Co.	M. Robert Thomas Brown, Secrétaire de la Cie	" "
Compagnie Française des Câbles télégraphiques	M. J. Depelley, Administrateur-Directeur	" "
	Mr. le Marquis de Lauris, Administrateur	" "
	M. N. Piétri, Inspecteur	" "
The African Direct Telegraph Co.	M. le Marquis of Tweeddale, Vice-Président	" "
The Black Sea Telegraph Co.	Lord Sackville Cecil, Vice-Président	" "
The Brazilian Submarine Telegraph Co.		
The Eastern Telegraph Co.	Sir Albert J. Leppoc Cappel, K.C.I.E., Membre du Conseil de l'Administration	" "
	J. Bolton, Représéntant de la Compagnie en Autriche	" "
The Eastern Extension Australasia and China Telegraph Co.	M. J. Denison Pender, Directeur-Administrateur	" "
	M. Jules Despecher, Représentant des Cies à Paris	" "
	M. F. E. Hesse, Secrétaire	" "
The Eastern and South African Telegraph Co.	M. G. Draper, Secrétaire	" "
	M. F. E. Hesse, Secrétaire	" "
The Europe and Azores Telegraph Co.	M. W. Hibberdine, Chef de Bureau	" "
The Pacific and European Telegraph Co.	M. W. H. Axworthy, Chef de la Comptabilité	" "
The West African Telegraph Co.	M. G. R. Neilson, Secrétaire	" "
The West Coast of America Telegraph Co.	M. H. St. L. Smith, Sous-Chef de Bureau	" "

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

[*Compiled expressly for this journal by* W. P. THOMPSON & Co., *Electrical Patent Agents, 322, High Holborn, London, W.C., to whom all inquiries should be addressed.*]

NEW PATENTS.—1896.

13,145. "Improvements in the construction of ammeters and voltmeters." T. J. BAKER. Dated June 15th.

13,195. "Improvements in or connected with automatic switches for controlling electric lamps." W. J. DAVY. Dated June 15th.

13,250. "Improvements in telelephonic apparatus." C. ADAMS RANDALL. Dated June 16th. (*Complete.*)

13,263. "A frictional grip for sliding rods, applicable to holders of electric lamps, carbons, and the like." W. L. PREECE. Dated June 16th. (*Complete.*)

13,264. "Improvements in regulating induction electric motors." THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED. (A. H. Armstrong, United States.) Dated June 16th. (*Complete.*)

13,267. "Improvements in electric switches for street railways and the like." W. R. DAGGETT and W. H. HEINZ. Dated June 16th. (*Complete.*)

13,271. "Improvements in electric switches." J. B. VERITY. Dated June 16th.

13,295. "Improvements in or relating to electrically-controlled railway signals." W. P. THOMPSON. (F. McBrien, J. Wayland, and J. H. Fleming, United States.) Dated June 16th. (*Complete.*)

13,297. "Improvements in and relating to electric furnaces." R. PIGNOTTI, F. LORI, S. REGNOLI, M. PANDALEONI and M. BESSO. Dated June 16th. (*Complete.*)

13,339. "An improved controlling and feeding mechanism for electric arc lamps." H. S. JACQUES. Dated June 17th.

13,362. "Improvements in telegraphic codes." S. K. JORDAN. (M. L. Dufour, Argentine Republic.) Dated June 17th.

13,405. "Improvements in dynamo electric machines." W. M. MORDEY. Dated June 17th.

13,407. "Improvements in electrolytic apparatus." C. KELLNER. Dated June 17th.

13,449. "Improved blasting apparatus for mining and other purposes fired by pressure heat or electricity." C. MACKINTOSH. Dated June 18th.

13,485. "Improvements in telephone-switchboards." I. ANDERSON, R. WILSON HUTCHISON, and C. E. VAN CUREN. Dated June 18th. (*Complete*).

13,488. "Improvements in electric incandescent lamps." G. BAMBERG. Dated June 18th.

13,496. "Improvements in incandescent electric lamps." E. J. SANDER and A. CLIFFORD. Dated June 18th.

13,520. "Improvements in plates for accumulators or secondary batteries." C. POLLAK. Dated June 18th. (*Complete*).

13,521. "Improvements in the manufacture of carbon anodes for electrolytical processes." P. JENSEN. (H. Cappelen and D. Cappelen, Norway.) Dated June 18th.

13,522. "Means or apparatus for use in measuring power in alternating current circuits." A. F. BERRY. Dated June 18th.

13,542. "The electric typewriter." M. MCGOWAN. Dated June 19th.

13,553. "A hygienic ear-piece for telephone receivers and such like." G. DUBBERT. Dated June 19th. (*Complete.*)

13,644. "Improvements in electrical accumulators." F. W. GREENGRASS and S. R. DOCKING. Dated June 20th.

13,645. "Improvements in electric wiring and in apparatus for making connection therewith." J. D. F. ANDREWS. Dated June 20th.

13,646. "Improvements relating to electric accumulators or storage batteries and to the manufacture of plates or electrodes therefor." W. H. SMITH and W. WILLIS. Dated June 20th.

13,688. "Improved electrical apparatus for the treatment of air, gases, and vapours." A. E. BONNA, A. LE ROYER, and P. VAN BERCHEM. Dated June 20th.

13,689. "Improved electrical apparatus for the treatment of air, gases, and vapours." A. E. BONNA, A. LE ROYER and P. VAN BERCHEM. Dated June 20th.

13,690. "Improvements in electrolytic apparatus." A. LE ROYER, A. E. BONNA, and P. VAN BERCHEM. Dated June 20th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

[*Copies of any of these Specifications may be obtained of* Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., *price, post free,* 8½*d.* (*in stamps.*)]

1895.

3,864. "Improvements in the control of electro-motors." E. A. SPERRY. Dated February 22nd, 1895. (Date claimed under Patents, &c., Act, 1883, Sec. 103, July 24th, 1894, being date of application in United States. Relates to a system for controlling electric machines, and consists in the arrangement of certain details of the electric machine, such as commutator brushes, devices for controlling their movement and mechanism for the current control of the electric machine. 14 claims.

5,451. "Improvements in self-recording electric meters." A. WRIGHT. Dated March 15th, 1895. Relates to the application of maximum and minimum recording liquid indexes, which record by the displacement of liquid to ampere and voltmeters which work by electro-magnetism. These liquid indexes are also applied to ampère and voltmeters working by the expansion of solids or liquids caused by the heat generated by electric currents passing through them. Reference is made to patent 583, of 1893. 3 claims.

5,892. "A device for the better regulation of electrical currents." J. HALL, J. H. ROBOTTON, and F. C. GEARY. Dated March 21st, 1895. Describes a device for regulating electric currents, in which a resistance mixture of conducting and non-conducting granular or pulverised materials is contained in a receptacle. Means are provided for bringing more or less of the resistance mixture into the circuit as required. 2 claims.

7,788. "Improvements relating to electric arc lamps." W. R. RIDINGS, G. F. BALL, and L. BARBANK. Dated April 18th, 1895. Describes a brake mechanism, comprising a roller mounted on toggle levers, so that when these latter are operated by a coil or solenoid, the roller is caused to clutch or leave a friction wheel or drum which controls the carbon holder. 2 claims.

8,373. "Improvements in conductors for coupling cells of voltaic batteries. W. S. RAWSON. Dated April 27th, 1895. When a coupling is connected directly to the positive electrode of a cell at one end and the negative electrode at the other end, owing to the galvanic action set up between the different metals, they become rapidly deteriorated. To obviate this, the conductor is made in two parts, one terminating in a spring socket and the other in a plug. These, when joined together, are protected by a caoutchouc tube. 2 claims.

11,544. "Improvements in the manufacture of the insulator arms of telegraph poles for carrying conductors of electricity generally." BULLERS, LIMITED and E. J. CHAMBERS. Dated June 13th, 1895. Insulator arms are made from two pieces or half-arms of oak or other hard wood, these arms being connected and bound together by a tubular sleeve of iron or steel in the middle portion of the insulator arm. 1 claim.